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PROBLEMS IN FARM WOODWORK

BLACKBURN

The Manual Arts Press

Peoria, Illinois

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PROBLEMS IN FARM WOODWORK

FOR AGRICULTURAL SCHOOLS, HIGH SCHOOLS, INDUSTRIAL SCHOOLS, AND COUNTRY SCHOOLS

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THE MANUAL ARTS PRESS
PEORIA, ILLINOIS
1915

TT 180
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$1.00
JAN -8 1916
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PREFACE.

IN many states laws have been passed, requiring the teaching of industrial subjects in all schools within the state. In many instances state funds are provided to aid this work in the high schools of farming communities, and in rural schools. The trend of the manual training courses in such schools is toward practical work, and toward correlation with agriculture.

In many of these agricultural high schools, short courses are given during the four winter months for the benefit of those young men and women on the farm who have found it impossible to attend school thruout the year. To the young men in these classes, the practical work that can be given in the manual training courses appeals strongly. In many cases, boys become enough interested in work of this character to procure sets of tools for use in their own shops on the farm. With the understanding of the use of tools and of terms used in woodworking such as are learned in the manual training classes, and with the help of problems such as are offered in this book, these boys can work out many things by themselves and become proficient in this kind of work.

It is not intended that this book be used as a text, altho by selecting problems from it an efficient course of study could be worked out by the instructor. The aim of this book is to place before the teacher and pupil the best forms, the best construction and the correct dimensions of objects that can be correlated with work in agriculture.

There may be a tendency toward careless work by some pupils in problems as large as these, and it must be impressed well upon the mind of each student that there is great need for accuracy in all these problems, else the educational purpose of the work will be defeated.

In getting together these problems the author has consulted successful farmers, fruit growers, bee raisers, gardeners, carpenters, and other workmen in order to get the best type of each problem, and to make it simple, practical, and the best fitted for its particular use. He has designated kinds of material that may be bought from any lumber yard and hardware store, and has used only the commercial sizes of lumber.

Suggestions for a few of these problems have been taken from bulletins issued by the United States Department of Agriculture, the Manual Training Magazine, a Minnesota University bulletin, and a Kansas State Agricultural College bulletin. The author is most indebted, however, to the students who have worked with him during past years.

S. A. BLACKBURN.

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WORKING DRAWINGS
AND
WORKING DIRECTIONS

SACK HOLDER.

Purpose. This sack holder will appeal to the boy for its great convenience in many ways. It not only supports the sack in an upright position, but also holds open the mouth of the sack making it easy to fill without an extra helper.

Material.

One piece 1¾″x10″x15¼″, oak or some heavy wood.
One piece ¾″x8″x6′8″ pine.
Twenty-two 1½″ No. 9 screws.

Bill of Stock. Finished dimensions.

One piece 1¾″x10″x15″, for base.
Two pieces ¾″x8″x3′3″, for uprights.
Two pieces ¾″x1½″x8″, for cross cleats at top.

Tools. Saws, plane, compass, pencil, try-square, wood file, screw-driver, brace and $\frac{7}{32}$″ twist drill.

Directions. Finish the base to dimensions given in the drawing. Lay off the two upright pieces. (This problem should be constructed in such a way as to keep the weight as much as possible at the bottom, hence the cutting away of the uprights, leaving just enough strength to support a full sack. Shape the uprights according to the drawing, sawing the curves with a coping saw and finishing the middle straight part with a rip saw. Use part of this wood sawed out for the cross cleats at the top.

Assembly. Put on the cleats at the top, using three screws in each. Fasten uprights to base, using eight screws on each side. A number of screws are necessary at this point, since the holder is purposely made a little wide, allowing spring at the top to hold the mouth of the sack apart with a firm grip.

NAIL BOX.

Purpose. The nail box is one of the best problems that can be used, being suitable for any community. Many of these boxes have been devised, but usually they are too small. This one is large enough, and convenient.

A knife box may be designed from the same drawing by leaving out the partitions and making the base 8″x12″ and the depth of the box 2¼″.

Material.

One piece ½″x10″x16″, pine or basswood.
One piece ½″x8″x2′10″.
One piece ¾″x6″x15½″.
A number of 6d. finishing nails.

Bill of Stock. Finished dimensions.

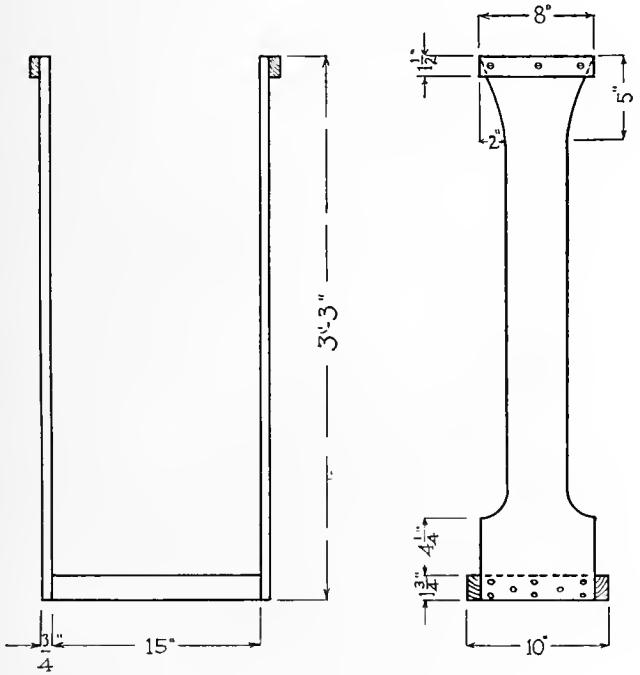
One piece ½″x10″x16″ for base.
Two pieces ½″x3¼″x16″ for sides.
Two pieces ½″x3¼″x9″ for ends.
One piece ¾″x5½″x15″ for handle.
Three pieces ½″x3¼″x4⅛″ for partitions.

Tools. Saw, plane, rule, pencil, try-square, brace, $\frac{1}{8}$″ bit, chisel, hammer and wood file.

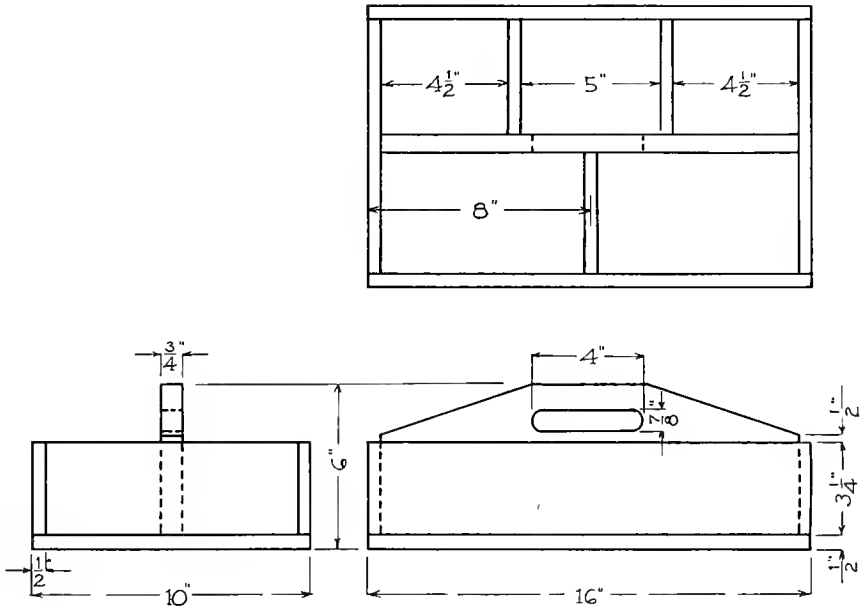
Directions. Make the sides, ends, and partitions from the 8″ board. Rip the board thru the middle the entire length and lay out and finish pieces to dimensions given in bill of stock. Finish the base board to correct dimensions. To make the handle partition, plane the $\frac{3}{4}$″ piece to $\frac{3}{4}$″ x $5\frac{1}{2}$″ x 15″. With a pencil gage draw a line on both sides of the piece $1\frac{1}{4}$″ from the edge. Locate the center of this line, also locate point 2″ on each side of the center. Set compass to $\frac{7}{16}$″ radius. Put the lead point on the points last found and the compass point in the line, and draw a semi-circle. Repeat at opposite end. Connect semi-circles with straight lines. To shape handle partition, measure in $5\frac{1}{2}$″ from each end, and down $1\frac{1}{2}$″ from the same point. Connect the points just made. Bore out the handle hole with the $\frac{7}{8}$″ bit, and chisel the wood remaining. Saw and plane to the slant lines. Round off sharp edges of handle with plane and wood file.

Assembly. Nail first the sides to base, then nail in the ends. Nail in the handle partition, then the cross partitions. These may be arranged to suit the workman.

SACK HOLDER



NAIL BOX



TOOL CARRIER.

Purpose. These tool carriers are excellent for use as tool receptacles, as well as for carrying tools from one place to another. The first carrier is made low so that it will easily slide under the seat of a buggy. It is somewhat difficult of construction, there being several hopper joints. The second is perhaps more easily carried, as it may be held in several different positions, or two men may each take an end. Both carriers will serve the same general purpose.

No. 1.

Material.

One piece ½″x8″x2′9″ pine.
One piece ¾″x8″x3′1″.
One piece ½″x6″x8′6″.
One piece 1¼″x2″x3″.
A number of 6d. common nails.

Bill of Stock. Finished dimensions.

One piece ½″x8″x2′9″ for bottom.
Two pieces ½″x5½″x3′2″ for sides.
Two pieces ½″x5½″x12″ for ends.
One piece ¾″x7½″3′½″ for handle partition.
One piece 1¼″x2″x3″ for saw holder.

Tools. Saw, plane, T-bevel, brace, 1″ bit, rule, pencil, compass, chisel, and hammer.

Directions. Set T-bevel on the square at an angle of 5″ to 3″. (See the illustration at the left upper corner of the plate.) Use this angle in making all the joints. Make the bottom board 2′8″ long plus the length added by beveling the ends. Plane the side pieces to 5½″ wide and bevel the edges as shown in the end view of the drawing. Make the upper edge of the side pieces 3′2″ long; from these longest points draw lines at an angle with the T-bevel, and saw. Make the ends in the same manner. It is best to nail the box part together before making the handle partition. The longest inside measurement of the carrier is 3′½″. Lay off this length at a point 4½″ from the lower edge of the handle partition. Using the T-bevel mark the slant, and saw. Notice that the opening in the handle is 9″ long. This allows the carrier to balance well even though the tools are heavier at one end. Lay out the opening for the handle 1½″ from the upper edge. With a 1″ bit bore out the wood, and finish with a chisel. Taper the handle as shown in the drawing. To make the saw holder, use a saw that cuts a small kerf. Carry the saws teeth up.

No. 2.

Material.

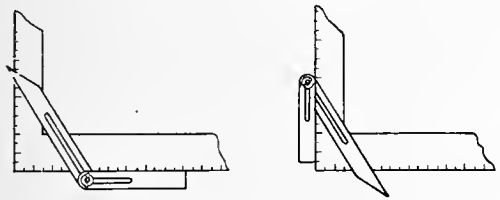
One piece ½″x12″x2′6½″ pine.
One piece ½″x10″x2′6½″.
One piece ¾″x12″x2′4″.
One piece ¾″x7″x2′6½″.
A number of 6d. common nails and 6d. finishing nails.

Bill of Stock. The pupil will make out his own bill of stock.

Tools. Saws, plane, chisel, rule, pencil, gauge and hammer.

Directions. The construction of this carrier is simple, the end pieces being the only ones that require any work other than sawing and planing. To make the ends, mark points on each edge 4½″ from the bottom. Find the middle of the upper end, and mark points 1″ on each side of the middle. Connect the two sets of points which mark the slant on the ends. Make the notch in the middle of the upper end so that it will allow the handle to slip down snug and tight. Saw the notch to exactly ¾″ wide and 1½″ deep, and chisel out the piece. Saw off the corners leaving a little space for planing a smooth surface. Round off the sharp corners at the top and on the handle, but leave the ends of the handle with sharp edges to fit into the notches.

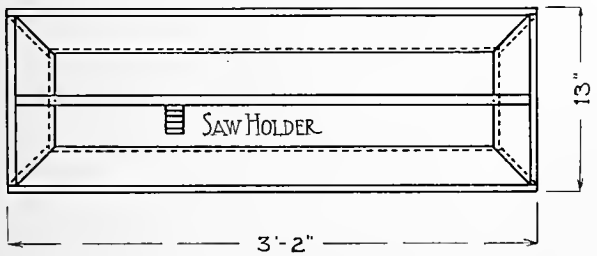
ILLUSTRATION SHOWING HOW TO SET
A T-BEVEL AT A GIVEN ANGLE

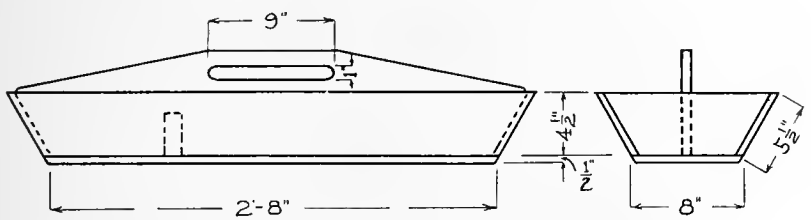


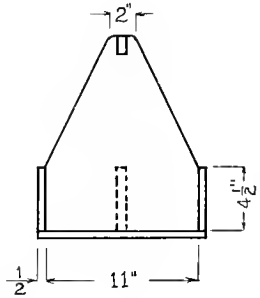
No 1

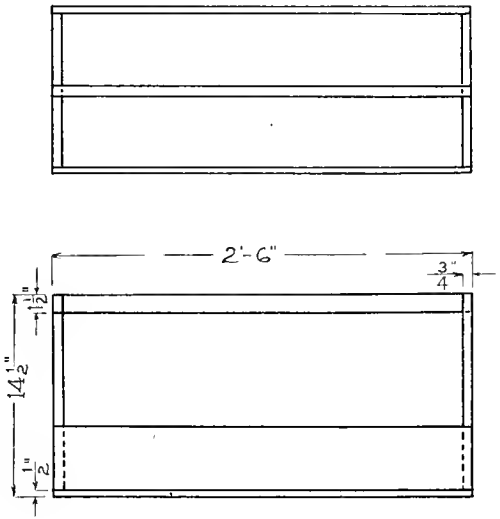
TOOL CARRIER

No. 2









SAW HORSES.

Purpose. Saw horses are needed wherever woodworking of any kind is done. They are used also by painters, paperers, plasterers, brick layers,—in fact, every tradesman has use for a set of saw horses. Saw horse No. 1 is especially good for a cabinet maker or one who repairs furniture. The cotton and canvas pad does not mar the wood in fine cabinet work, nor the finish of any article of furniture that is being repaired. Horse No. 2 is light and easily moved, and especially good for light material; while No. 3 is made for holding heavy timbers. The measurements in each instance may be changed to suit any special or individual need. A horse used by a painter is often made six to eight inches wide at the top with cross pieces nailed on to the legs to make a ladder. This wide top affords a platform for the painter to stand on. Carpenters sometimes make these horses six or seven feet high with the ladder part attached, and use them for working on low buildings, using them instead of ladders and staging.

No. 1.

Material. Pine, basswood, or any light wood.

Pine, basswood, or any light wood.
One piece ⅞″x8″x8′.
One piece ⅞″x6″x24″.
One piece ⅞″x4″x19″.
One strip of canvas 13″x3′10″.
One strip of canvas 15″x3′10″.
Two dozen 1½″ flat head screws.
Some cotton or excelsior.
A number of tacks and 8d. common nails.

Bill of Stock. Finished dimensions.

Four pieces ⅞″x4″x2′3″ for legs.
Two pieces ⅞″x4″x3′6¼″ for stretchers.
Two pieces ⅞″x6″x12″ for ends.
Two pieces ⅞″x2″x19″ for end braces.

Tools. Saw, plane, rule, pencil, try-square, T-bevel, screw-driver gage and hammer.

Directions. Set the T-bevel on the square at an angle of 3″ to 8″. (See illustration on Plate 2.) This angle is used to lay out the bevel on the legs, also the bevel of the upper edges of the stretchers and the ends and braces. Lay out the bevel on each leg and piece, and saw and plane to the dimensions given in the bill of stock.

Assembly. Put the stretchers on each pair of legs with screws. Nail on the ends and lower braces. Screws may be used in the end pieces, but nails will do very well. Before putting on the lower piece of canvas be sure that no sharp edges are underneath the canvas to make it wear easily. Stretch the canvas over tightly and tack securely; put in the cotton or excelsior and tack on the top piece of canvas as shown in the detail in the drawing.

No. 2.

Material. Pine.

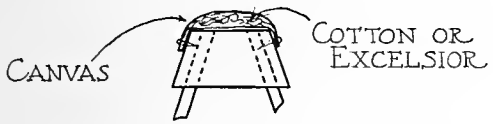
One piece 2″x4″x3′.
One piece ⅞″x8″x5′6″.
Thirty-two 1½″ flat head screws.

Bill of Stock. Finished dimensions.

One piece 2″x4″x3′ for stretcher.
Four pieces ⅞″x4″x2′2½″ for legs.
Two pieces ⅞″x4″x13¼″ for braces.

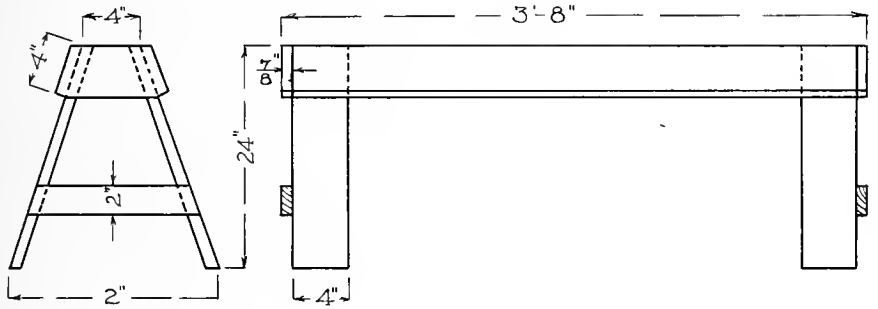
Tools. Saws, rule, plane, pencil, try-square, screw-driver, T-bevel, chisel and mallet.

Directions. Saw and plane the different pieces to sizes indicated by bill of stock. Set the T-bevel at an angle of 1″ to 6″. Measure in 4″ from each end of the 2″ x 4″ piece and mark straight across the top side with the try-square. At each end of this line, drop down on the sides of the 2 x 4 using the given angle of the T-bevel. Draw lines 4″ further

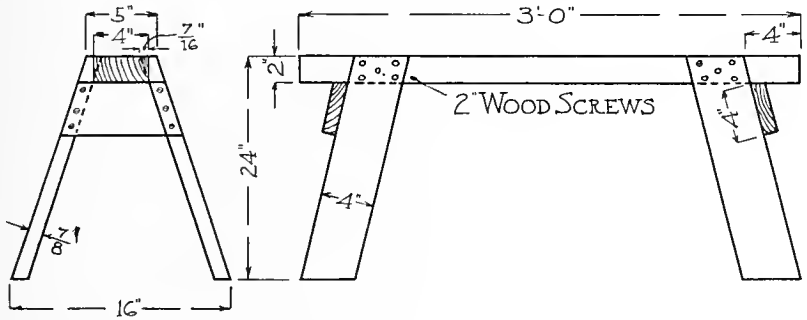


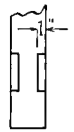
SAW HORSES

No. 1

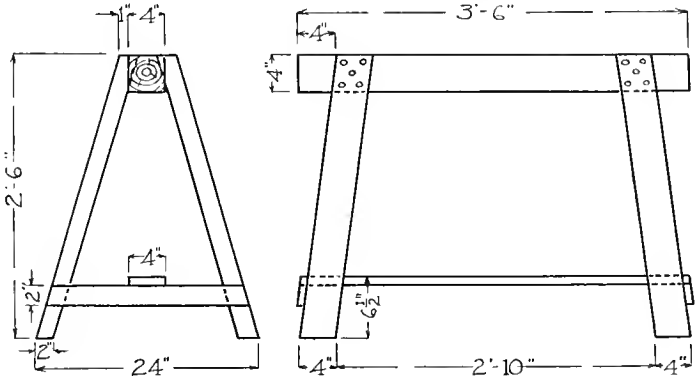


No. 2





No. 3



in on the 2 x 4 and parallel to the lines just drawn. Set the gage to $\frac{7}{16}$″ and gage between the lines on the top side, leaving the lower edge flush, as shown in the detail. Saw and chisel out the triangles thus formed. Bevel off opposite ends of the legs to make them stand level on the floor. Lay out and saw the brace for each end of the saw horse. Bevel the upper edge to make it fit up under the stretcher.

Assembly. Fasten the legs with 2″ screws, using four or five screws for each leg. Also fasten on the end braces with screws.

No. 3.

Material. Pine.

One piece 4″x4″x3′6″.
One piece 2″x4″x10′6″.
One piece $\frac{7}{8}$″x4″x5′4″.

Assembly. This problem is so much like saw horse No. 2 that the bill of stock and directions will almost be a repetition. The pupil with a little thought, can make out his own bill of stock and manner of procedure. If all points are not clear, then the directions for No. 2 may be resorted to.

HANDLES.

Purpose. The ability to make handles proves most useful when a handle is broken and work must stop until some one goes to town after a new one. These handles are the types of the kinds used around a shop. Wood for handles should be tough, not brittle, and close grained. Ash is sometimes used, and sometimes a good piece of willow can be found. Second growth hickory is the best material for handles. By this we mean the quick growing sprouts that come up around the stump after the old tree is cut down. Slow growing hickory is more brittle and has more knots, making it less adaptable.

Hammer Handles.

Material.
One piece 1⅜″x1⅝″x14⅛″ hickory.

Bill of Stock. Finished dimensions.
One piece 1⅜″x1½″x14″.

Tools. Saw, plane, try-square, rule, gage, spokeshave, and wood file.

Directions. Square up material to dimensions given in bill of stock. On wide surfaces, beginning 5½″ from one end, draw slanting lines, tapering from 1½″ at the 5½″ mark, to 1⅛″ at the other end, and plane to slanting lines. On narrow surfaces, from the same point, draw slanting lines tapering from 1⅛″ to ⅝″ at the small end, and plane to lines. With spokeshave shave the small part of the handle to 1$\frac{1}{16}$″ in width and ¾″ in thickness, bevel corners with spokeshave so that handle will be eight-sided, after which remove each sharp edge, making the handle elliptical in cross section from large end to within 3″ of small end. The small end, which is to go thru the eye of the hammer head, should be left nearly rectangular, with corners slightly rounded. Smooth the handle with fine sandpaper and put on a thin coat of orange shellac or linseed oil. The boy should be encouraged to make a handle to fit some hammer at home, changing dimensions given in drawing if necessary. In fitting handle to hammer head the small end will probably have to be reduced in size. This can best be done with a wood file. When the small end has been driven well thru the eye of the hammer head, it should be split with a chisel and a sharp hardwood wedge driven in, spreading the end so that the hammer head will not fly off when being used.

Sledge Handle.

Material.
One piece 1⅜″x1¾″x2′8″ hickory.

Bill of Stock. Finished dimensions.
One piece 1⅛″x1½″x2′8″.

Tools. Same as for hammer handle.

Directions. Make the sledge handle with the same operations as are used in making the hammer handle.

Pick Handle.

Material.
One piece 2¼″x3¼″x3′ hickory.

Bill of Stock.
One piece 2″x3″x2′11½″.

Tools. Same as for hammer handle.

Directions. Same as for hammer and sledge handles. The difference between this and the foregoing handles is readily seen to be in the tool end of the handle. The sledge and hammer handles were made small to go thru the eye of

the hammer head, while the pick handle is largest at the pick end. The pick is slipped on from the back, thus needing no wedge, the constant driving and pulling keeping the pick in place.

Vise Handle.

Material.

One piece 7/8″x7/8″x16¼″ hickory or oak.
One dowel ½″x4″.

Bill of Stock. Finished dimensions.

One piece ¾″x¾″x16″.
Two dowels ½″x1½″.

Tools. Saw, plane, try-square, rule, gage, wood file, brace, ½″ bit, and compass.

Directions. Plane material to dimensions given in bill of stock. Draw a center line and measure in 1⅜″ from each end and mark. On these points bore ½″ holes. Draw circles on each end with the compass set at ⅜″ radius. Plane handle to eight sided figure, then sixteen sided figure and finish off edges with wood file. Round ends of dowels. Insert a dowel in one end and put in a small brad to hold in place. Slip the handle thru vise before inserting the other dowel.

File Handles.

Material.

One piece 1¼″x1¼″x12″ hickory.

Bill of Stock. Finished dimensions.

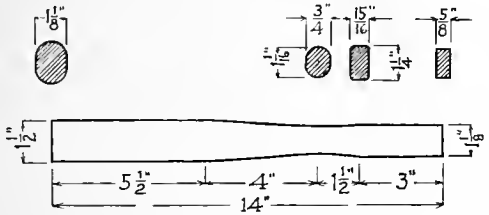
One piece 1″x1″x11⅛″.

Tools. Saw, plane, compass, rule, gage, spokeshave, wood file, and small gimlet.

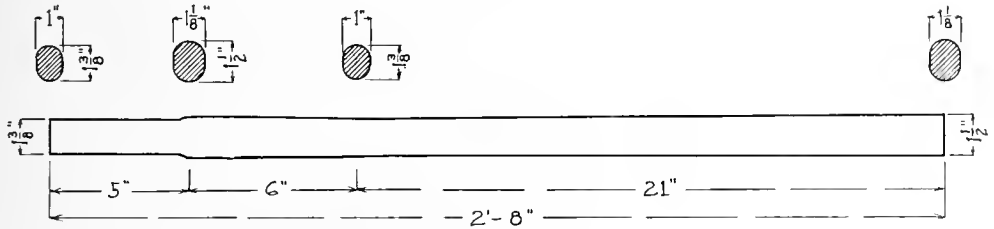
Directions. Square up material to dimensions given in bill of stock. Draw a regular eight sided figure at each end, and plane to these lines. Draw a circle at each end of ½″ diameter, and beginning back from end 3″, shave down with spokeshave to circle. Round off sharp edges with wood file. Bore a small gimlet hole in each end. Saw the piece into two equal parts, and round off the newly made ends with the file.

HANDLES

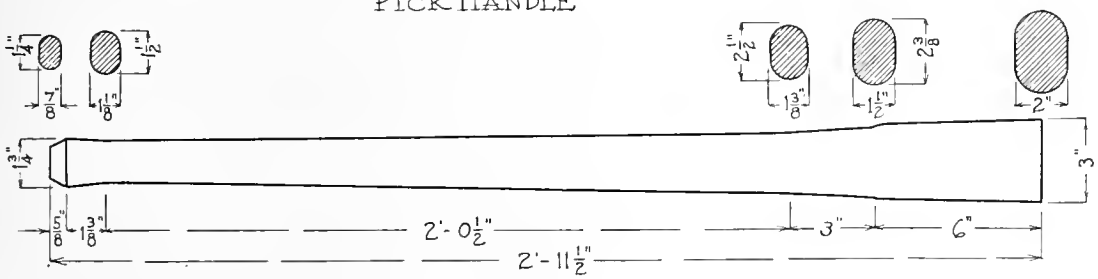
HAMMER HANDLE



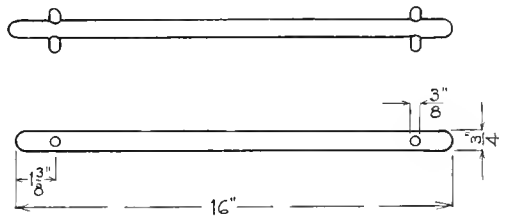
SLEDGE HANDLE



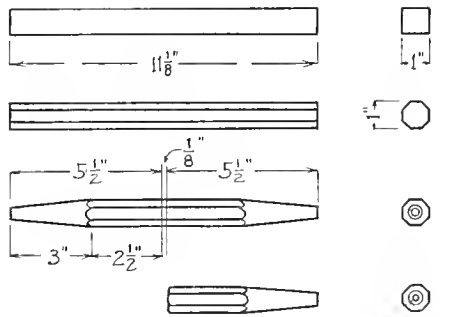
PICK HANDLE



VISE HANDLE



FILE HANDLE



DRAWING BOARD.

Purpose. A drawing board is a useful article in almost any trade or profession. If its use were better understood it would be a much more common article. It can be used for many things about the home as well as the office, not only for drawing plans, but for lettering work, design work, etc. It always furnishes a smooth flat surface which makes it very desirable.

This drawing board is one of the best types altho more difficult of construction than some others. The wedge shaped piece that has been pushed into the opening made for it allows the face of the drawing board to swell and shrink and yet keep its straight, smooth surface. More common types, the joints of which are shown at A and B, are more easily constructed, but not so good as the one shown here. Detail A shows the end of the board with a groove plowed out, and a lengthwise strip with a tongue fitting the groove, glued to the end grain. Detail B, the most easily constructed board, is merely the flat drawing surface with two strips screwed onto the back.

Material. Extra clear white pine.
One piece 7/8″x10″x6′6″.

Bill of Stock. Finished dimensions.
Eight pieces 3/4″x2½″x24″ for face of board.
Two pieces 3/4″x2½″x20″ for strips.

Tools. Saws, jointer plane, try-square, rule, pencil, gage, and chisel.

Directions and Assembly. The bill of stock calls for eight pieces 2½″ wide. This width is not absolutely necessary. Narrower pieces are even better. See that the end grain in each piece runs opposite to the one just before it, as shown in the side view of the drawing. Join enough pieces so that when completed the board will be 20″ wide. Before gluing, the pieces should be about 25″ or 26″ long so as to allow for errors in planing and assembling. Glue the pieces together. When the glue has set lay off and mark the opening for the wedge-shaped strips. This groove may be made with a special plane used for the purpose or by sawing down almost to dimensions and carefully chiseling the remainder. Bevel the strips and push into the opening made for them.

MITER BOX.

Purpose. The miter box is an almost indispensable article for the shop. Many large expensive miter boxes are now offered on the market, but as a rule they are not so dependable after they become worn as the miter box here shown. When this box is worn out it is an easy matter to make a new box. This box has an advantage in that it can be carried in an ordinary tool-box. You will notice the board projecting ½″ below the bottom. This forms a catch to hold against the edge of the bench or a place for a vise to hold.

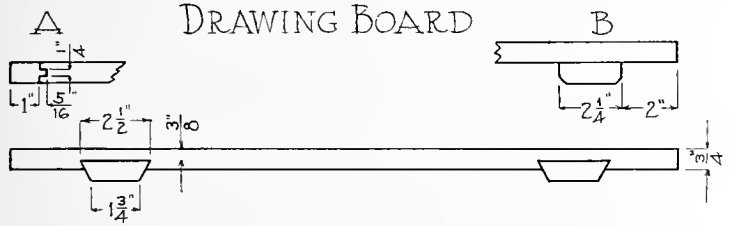
Material. Pine.
One piece 1¾″x4″x20″.
One pieee 3/4″x6″x3′4″.
Ten 1½″ No. 9 flat head screws.

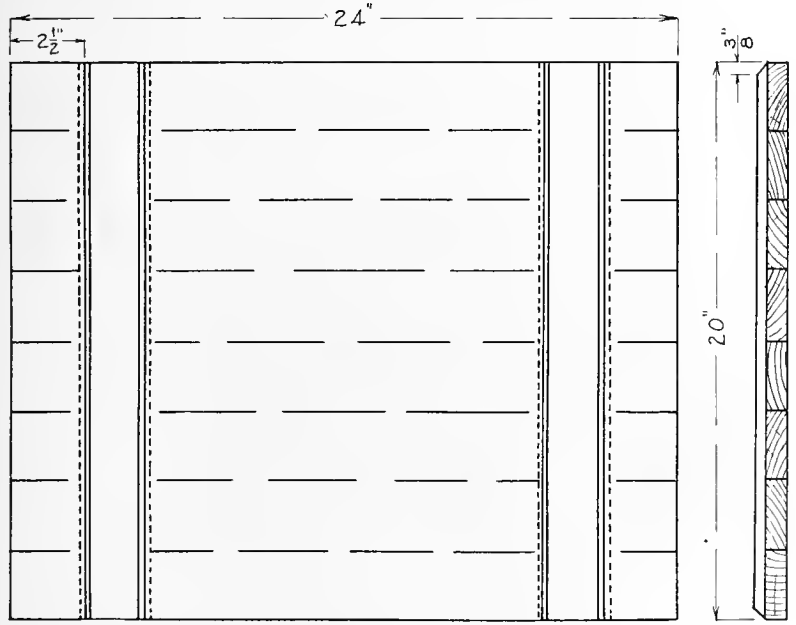
Bill of Stock. To be made by pupil.

Tools. Saws, plane, try-square, rule, pencil, brace, ½″ bit, and screw-driver.

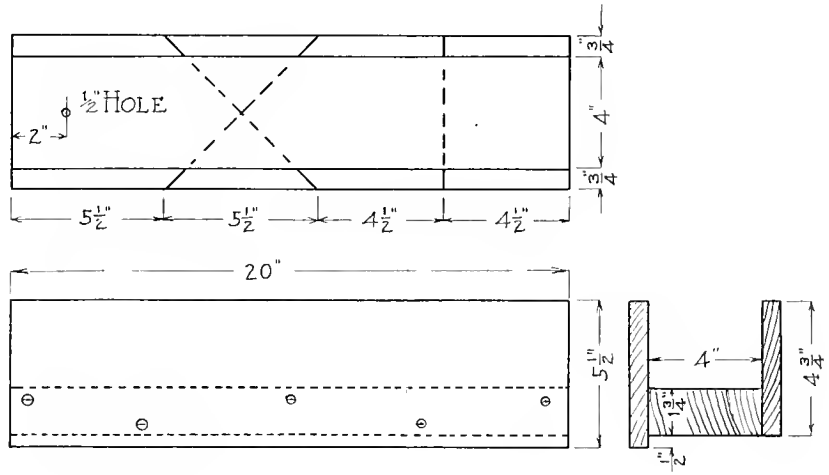
Directions and Assembly. Finish pieces to dimensions given in the drawing. Fasten with screws in about the positions shown. Especial care must be taken to keep everything straight and square as the correctness of the miter depends upon this. Measure in 5½″ from one end, and draw a line straight across with the square. Measure over

DRAWING BOARD





MITER BOX



5½″ farther, and square across; again measure over 4½″, and square across. With the square, drop lines down from each of these points on the outside of the box. Draw the diagonals between the first and second lines. Care must be taken in drawing all these lines, as a very small mistake will cause an error in the miter. Saw out these lines carefully.

SMALL TOOL CHEST.

Purpose. This chest is designed for a mechanic's tool chest that has to be moved about often. It is made small enough so that a handle may be put on the side, and the chest carried much the same as a suit case, altho handles may be put at each end for carrying heavy tools. The advantage of this chest is that it takes up little room and it is easy to transport.

Material. Pine or basswood.

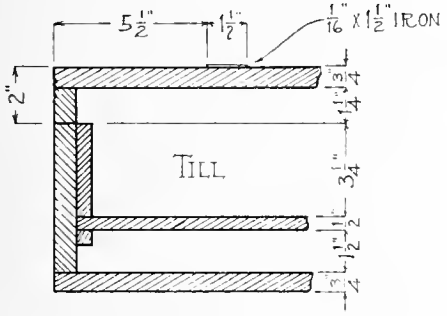
One piece ¾″x8″x16′.
One piece ½″x8″x8′.
One pair 2″ butt hinges.
One lock.
Five and one-half feet of 1/16″x1½″ iron.
A number of 6d. and 8d. common nails, also some screws or rivets.

Bill of Stock. The pupil may make out his own bill of stock by referring to the drawing.

Tools. Saws, plane, try-square, rule, pencil, brace, drill for holes for screws, countersink, chisel, screw-driver, gage, and hammer.

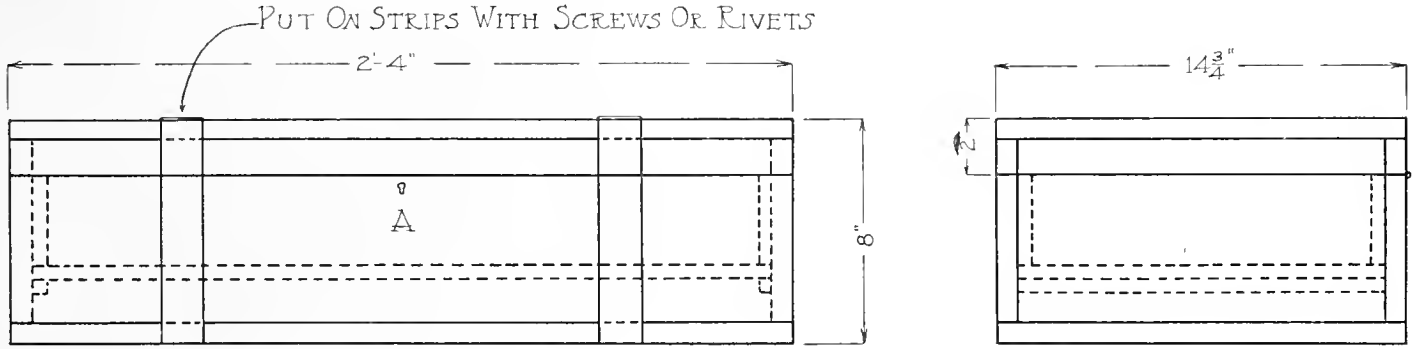
Directions. Glue two 8″ pieces together for the top, also two for the bottom. Work all pieces to dimensions shown in the drawing.

Assembly. Make the bottom part first. Nail the sides and ends together, and then nail on the bottom. Repeat this for the top section. Nail together the till. Nail in the two cross strips for the till to rest on, 4¾″ from the top of the lower box. Hinge the lid at the back, and put in the lock at the front. Cut and bend pieces of flat iron to proper lengths, lay out and bore the holes at convenient places, and fasten on either with screws or rivets.



SMALL TOOL CHEST

ONE HANDLE MAY BE PUT AT "A" AND THE CHEST CARRIED AS SUIT CASE



TOOL CHEST.

Purpose. The first thing a boy or man thinks of when he has secured some tools is a chest in which to keep them. The chest must be long enough to hold saws and have space enough at the bottom for the more bulky tools, such as planes and braces. It must have tills at the top to accommodate small tools that are difficult to find when put in the bottom with the larger tools. The till of the chest may be made the size of the upper part of the chest, but this necessitates the removal of the till to get at the tools in the bottom. The ordinary way of making tills is to have them about one-half or two-thirds the width of the chest. They are made to slide backward and forward, enabling the owner to get at tools below without lifting out the tills. The bottom one may be made stationary and the upper one movable. Some chests are made with only one till. This chest is designed to meet all requirements. The tills are made 8″ wide. An important requirement of a chest is that it shall be strong enough to withstand hard usage. To add to its strength and durability a metal top is put on and metal corners are used at the bottom. Screws are used to a great extent instead of nails.

Material.

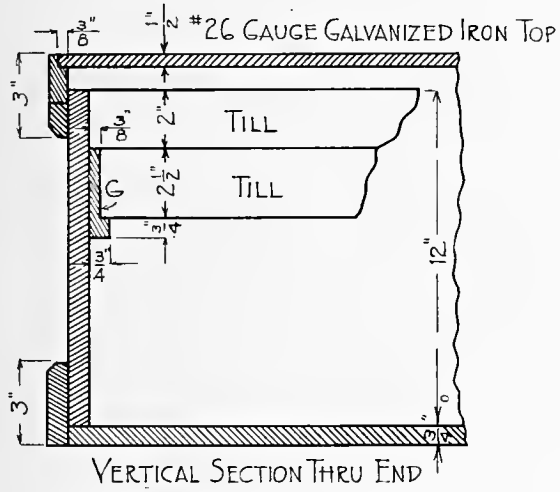
One piece ¾″x8″x16′.
One piece ¾″x12″x8′.
One piece ½″x8″x10′.
One piece ½″x8″x8′.
One piece No. 26 gage galvanized iron 18″x2′11″.
Four pieces No. 26 gage galvanized iron 2″x4″.
One pair 3″ butt hinges.
One lock.
Five dozen 1¼″ No. 9 screws.
A number of tacks and 8d. finishing nails.

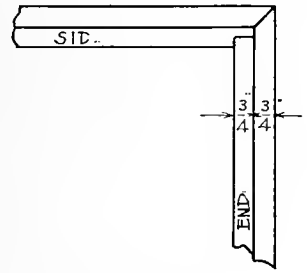
Bill of Stock. The pupil will make out his own bill of stock.

Tools. Saws, planes, miter box, chisel, screw-driver, brace, and set of twist drills, tinner's shears, mallet, try-square, square, rule, pencil, and gage.

Directions. Cut all pieces to dimensions shown in the drawing. Glue together two 8″ boards for the top and bottom pieces and saw to dimensions. Lay off and cut rabbet joint as shown in detail of corner. Plane ⅜″ chamfer on pieces marked A, B, C, D, but do not miter corners at this time. Plow pieces E and F to one-half the thickness of the pieces and ½″ deep so as to let in the ½″ top piece. Do not miter. Plow out piece G leaving ¾″ at the bottom for a support for the lower till, or use ½″ piece and nail on a cleat below.

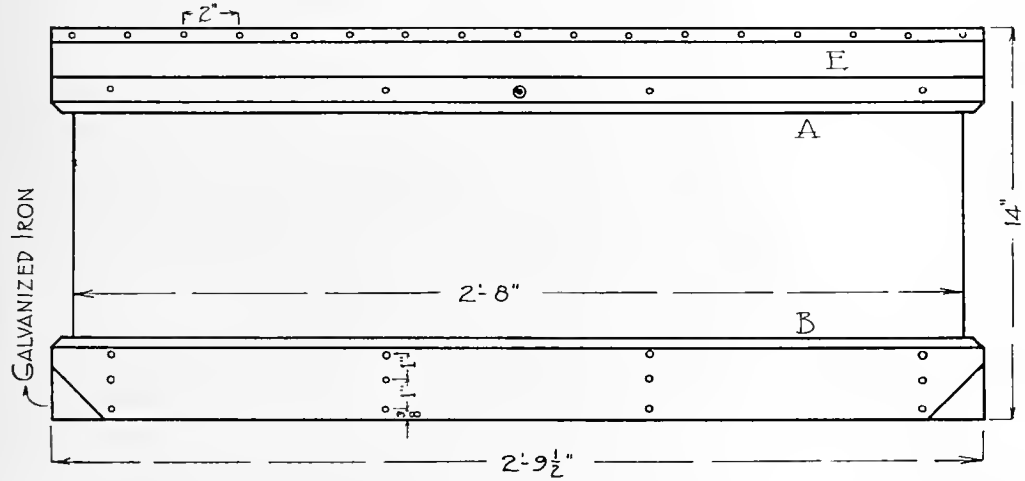
Assembly. Nail the sides and ends together. Put on the bottom piece. Miter one corner of one of the base pieces. Place exactly even with one corner and mark the other corner and miter to line. Cut each side in the same way, being careful that each piece is put on the side for which it was measured. Treat each of the four pieces that support the lid in the same way. Miter pieces E and F in the same way. Fit in top piece and nail. Nail in the support for the tills. Nail together both tills, and place them in chest. Now put on the galvanized iron top. Bend over one long edge ½″. Fit to an edge and tack on. Work down smoothly over the top and bend over opposite edge and tack. Starting at the center of each end and working toward the outer edges bend over the ends. With shears cut out corners carefully. Finish nailing. Put on the hinges and lastly the lock. Cut, bend, and tack on the four lower corner pieces.

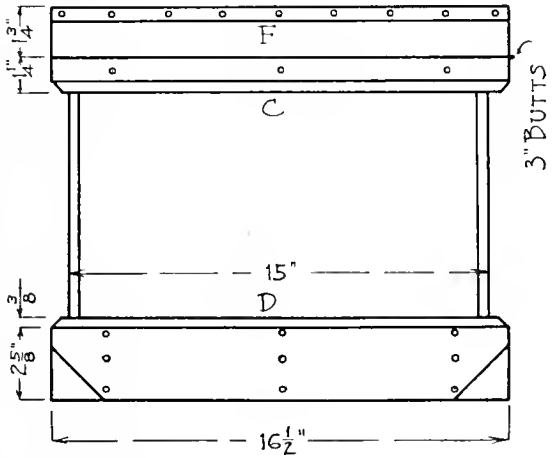




DETAIL OF CORNER

TOOL CHEST





NAIL CABINET.

Purpose. This cabinet should be found in every shop; its order, convenience, and economy being entirely worth the making. It is designed not only for nails, but also for staples of various kinds, roofing nails and tins, etc. To add to its convenience, print or paint below the mouth of each section the name and size of the article within. Eight penny nails will be marked "8d. com."

Material.

(1) Two pieces ⅞″x10″x16′pine.
(2) One piece ½″x12″x6′8″.
(3) One piece ½″x4¼″x3′3½″.
(4) One piece of tin 2′7¾″x3′3½″ or the same amount of thin wood for back, also a number of 6d. and 8d. common nails.

Bill of Stock. Make out the bill of stock from the drawing.

Tools. Saws, plane, hammer, chisel, square, try-square, dividers, rule, pencil, knife, gage, coping saw and half-round wood file.

Directions. Lay off and saw the two 10″ boards into pieces for the top, bottom, sides, and partitions as shown in the drawing. Make the joints in the horizontal partition first, using the saw and then chiseling down to ¼″. (If you have a router plane, set to ¼″ and plane.) Plane both edges of No. 2, in list of material. Set gage to 5½″ and gage a line from each edge of the board. This leaves the surplus material in the middle of the piece. Square one end of the board; measure in 4⅜″, and with square draw line entirely across the board; measure in four times, using 7⅝″ each time and draw lines across; lastly measure 4⅜″, and saw off to line. Repeat this same process on the remainder of the board. Set the dividers or compass to 3½″. Measure in 7¾″ on these lines and using this point as a center describe an arc, cutting the 5½″ gage line. From the opposite end of this line repeat the same process. Mark off on all lines. Rip the board into two pieces and plane down to gage lines. Saw out curves with coping saw and file edges smooth. Saw and plane off one of these 5½″ boards to 5″, for the lower face board in the drawing.

Assembly. Beginning at board A, nail on four of the 7¼″ partition boards. Place and nail the board C. Likewise put on boards D and E and partition boards. Fit and nail in end pieces. Nail on the lower face piece at bottom of cabinet. Nail on remainder of pieces to measurements shown in drawing. Tack on tin for back or nail on boards.

SCREW CABINET.

Purpose. As a companion for the nail cabinet, the screw cabinet is a most useful article in any shop. This cabinet is convenient not only for screws in gross boxes or paper sacks, but for small brads, double-pointed tacks, carpet tacks, small butt hinges, cupboard catches and other articles needed about a cabinet or woodworking shop. This cabinet is to be screwed or nailed to the wall in some convenient place.

Material.

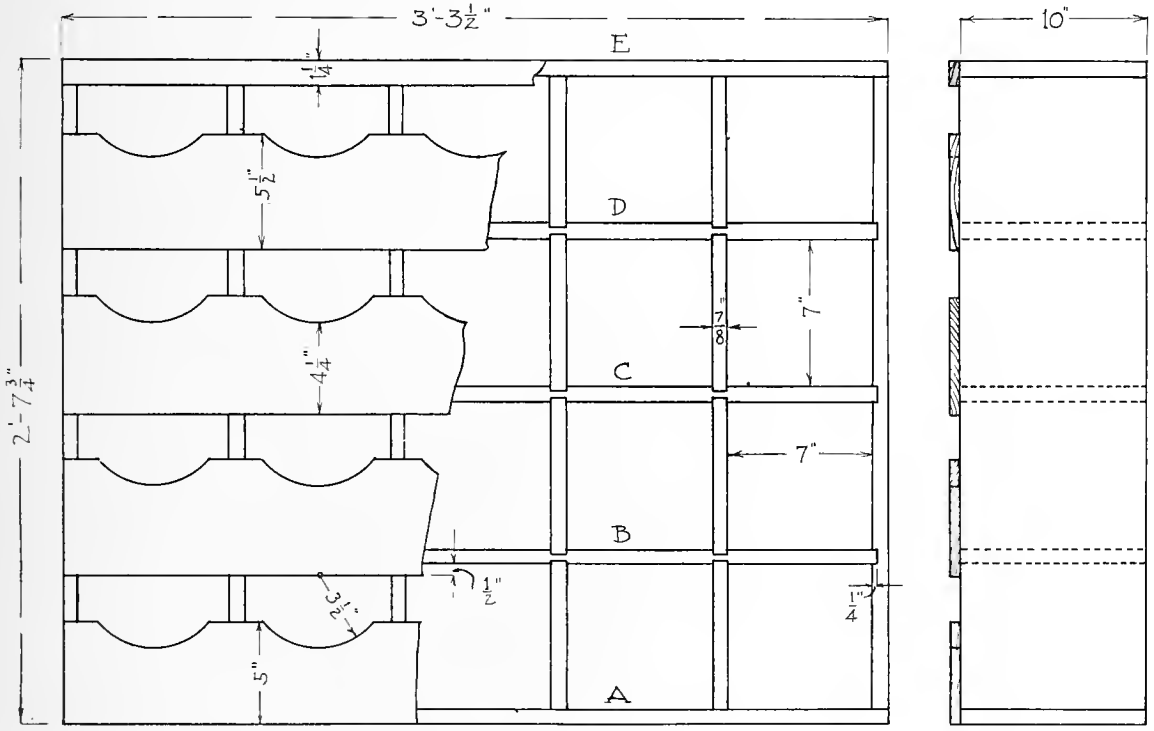
(1) One piece ¾″x8″x5′6″ pine.
(2) One piece ¾″x10″x12″.
(3) One piece ½″x12″x5′1″.
(4) One piece ½″x3¼″x6′6″.
A small hook, pair of 1½″ butt hinges, some glue, and a number of 7d. common nails.

Bill of Stock. The pupil will make his bill of stock by referring to the drawing.

Tools. Saws, plane, rabbet plane, brace, ⅜″ bit, try-square, chisel, pencil, rule, screw-driver and hammer.

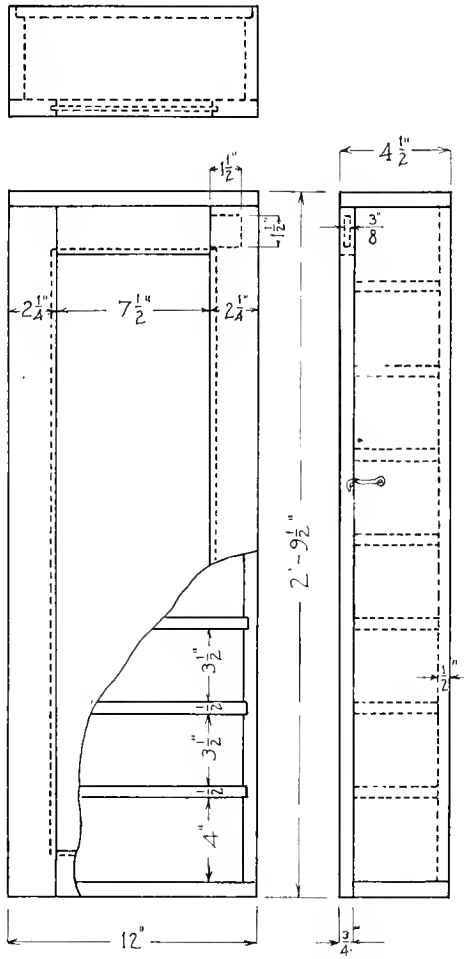
PLATE 8

NAIL CABINET



USE ANY THIN WOOD OR OLD TIN FOR BACK

SCREW CABINET



Directions. Saw and plane the different pieces to sizes indicated in the drawing. Board No. 1 in list of material will make pieces for the sides and door, and piece No. 2 will make the bottom and top pieces. On the two side pieces at the back and on the inside, plow out a space one-half the thickness of the board and $\frac{1}{2}$″ deep. Lay off on these boards beginning at the bottom, a point 4″ from the end and draw line across. Draw another line across $\frac{1}{2}$″ farther in, another $3\frac{1}{2}$″, then $\frac{1}{2}$″, and so on the length of the board. Saw and chisel out these grooves to the depth of $\frac{1}{4}$″. The shelves fit into these grooves. Make the panel door to the dimensions given in the drawing.

Assembly. Fit $\frac{1}{2}$″ shelves into side pieces and nail. Nail on the top and bottom pieces, and lastly the back piece. Put hinges and hook on the door.

WORK BENCH.

Purpose. Every farm needs a shop and work-bench suitable for carpentry, cabinet making, and all kinds of repair work. Three important points in its construction are that it be large, heavy, and strong. The height of the bench should conform to the height of the workman, and it should be twelve feet long, if possible, depending upon the size of the shop. It should be as wide as possible, and yet allow the men to reach the tools hanging on the wall above the bench, and it should be nailed to the wall to insure stability. Rough-sawed lumber from a common saw mill will do admirably for this bench. In fact the author has seen old bridge planks, and sills from an old house made into good benches. This element of economy should not be overlooked when trees and lumber are growing more scarce every day.

Material.

Four pieces $1\frac{3}{4}$″x10″x12′ oak or hard pine.
One piece 2″x4″x14′6″.
One piece $\frac{7}{8}$″x10″x10′.
One piece $\frac{1}{2}$″x12″x4′.
One piece 3″x4″x2′5$\frac{1}{2}$″.
One $1\frac{1}{8}$″ vise screw.
A number of 10d., 20d. common nails.

Bill of Stock. Finished dimensions.

(1) Four pieces $1\frac{3}{4}$″x10″x12′ for top.
(2) Four pieces 2″x4″x2′4$\frac{1}{2}$″ for legs.
(3) Two pieces 2″x4″x2′4$\frac{1}{4}$″ for cross pieces.
(4) One piece $\frac{7}{8}$″x10″x2′4$\frac{1}{4}$″ brace for legs at vise end.
(5) One piece $\frac{7}{8}$″x2″x2′7″ for vise brace.
(6) Two pieces $\frac{7}{8}$″x2″x2′11″ for vise brace.
(7) One piece $\frac{7}{8}$″x2$\frac{1}{2}$″x20″ for vise parts.
(8) One piece 3″x4″x2′5$\frac{1}{2}$″ for vise head.
The bill of stock for the drawer may be made by the pupil.
One $\frac{3}{4}$″ oak pin 3″ long.
Two $\frac{1}{2}$″ oak pegs, 4″ long.

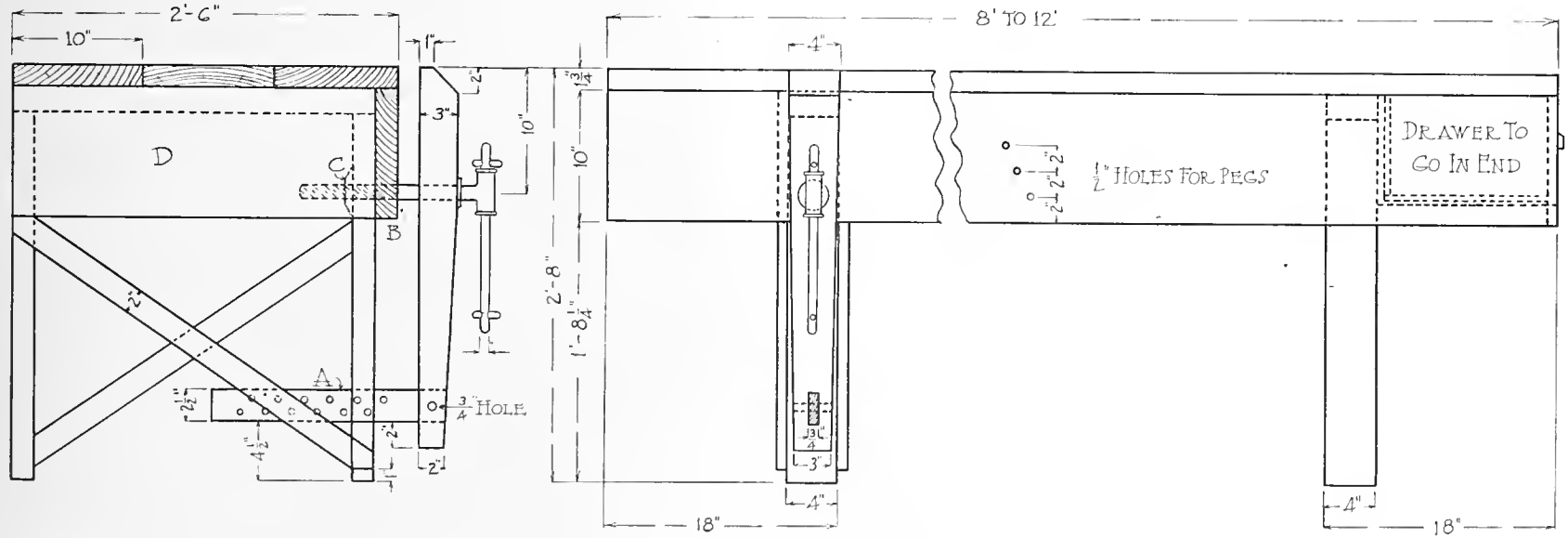
Tools. Saws, planes, hammer, square, T-bevel, try-square, rule, pencil, gage, brace, and $\frac{3}{8}$″, $\frac{1}{2}$″, $\frac{3}{4}$″, and extension bits.

Directions and Assembly. Cut out legs and top cross-pieces. On the leg that is to be directly under the vise cut a thru mortise $\frac{3}{4}$″ x 2$\frac{1}{2}$″. Cut this 4$\frac{1}{2}$″ up from the lower end. This thru mortise is for piece marked A to slide through. Bore two $\frac{1}{2}$″ holes thru this leg in position shown in drawing. Cut out and nail at the upper end of this pair of legs piece D in drawing, and No. 4 in bill of stock. Mark out and cut the braces, Nos. 5 and 6 in bill of stock, and nail into position. These braces are used to support the vise, the other pair of legs being without braces.

Nail plank marked B onto the legs, flush with the top. Lay first top plank even with plank B. Lay and nail the two remaining planks.

WORK BENCH

TO BE FASTENED TO WALL



Bore holes in piece No. 7 in bill of stock, marked A in drawing. Bore these in line with holes in leg to insure proper fitting of wooden pins.

Work piece No. 8, or vise head, to dimensions given in drawing. Use hard wood, preferably white oak, for this vise head.

Make the thru mortise at the bottom. Slide end of piece A thru until flush with outside of vise head. Bore a $\frac{3}{4}$″ hole in the center thru head and piece A, and fasten with a hard wood pin. Measure down 10″ from the upper end of vise head and bore a $1\frac{1}{8}$″ hole for vise screw to slip thru.

Fit vise head carefully into position and mark center for hole on piece B. Bore this hole thru piece B, and thru leg. Put on casting marked C in the drawing, and fit vise head into place.

This completes the vise, unless vise handle is to be made. On another plate a full drawing for a vise handle is given. The vise is widened by shifting piece A and also turning the vise screw at the upper end.

Bore $\frac{1}{2}$″ holes on the sides for $\frac{1}{2}$″ pegs to hold the longer pieces put into the vise. A convenient drawer may be put into the end of the bench for small tools.

ROW OF NESTS FOR LAYING HENS.

Purpose. This row of nests will be most convenient for every place where poultry is raised, whether in small or large flocks. The front is opened and the top is a hinged lid, convenient for gathering eggs.

Material.

One piece $\frac{7}{8}$″x14″x12′, pine or redwood.
One piece $\frac{7}{8}$″x14″x10′.
Three $1\frac{1}{2}$″ butt hinges and a number of 8d. common nails

Bill of Stock. The bill of stock has been left for the pupil to make out.

Tools. Saw, plane, rule, steel square and hammer.

Directions. Cut the 14″ board into lengths for the top and bottom, front piece, and door. The other board will make the remaining pieces.

Assembly. Nail the top and bottom pieces to the end pieces. Place and nail in back piece, then the division pieces. Nail on the 4″ front piece, then put on hinges which hold the trap door on top.

NEST FOR A SITTING HEN.

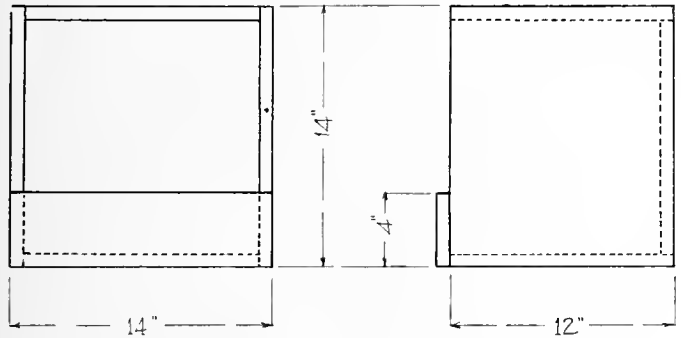
Purpose. This nest is convenient in that it can be moved around easily, a thing necessary when the eggs are hatching. It is also easily cleaned.

Material.

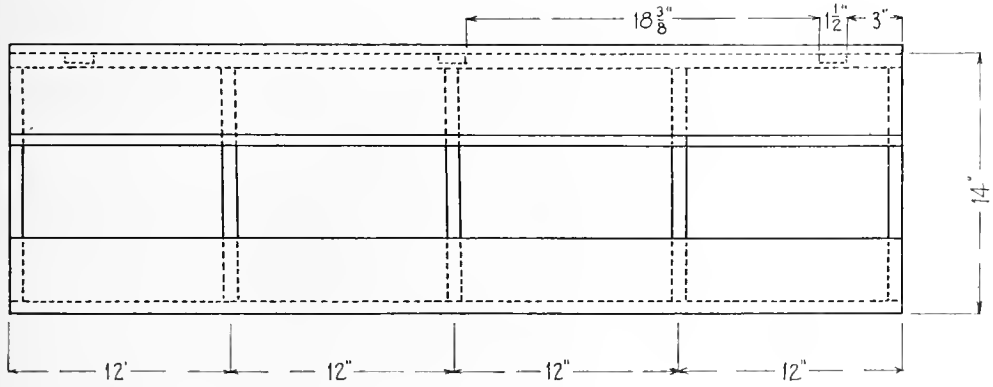
One piece $\frac{7}{8}$″x12″x6′8″.
A number of 8d. common nails.

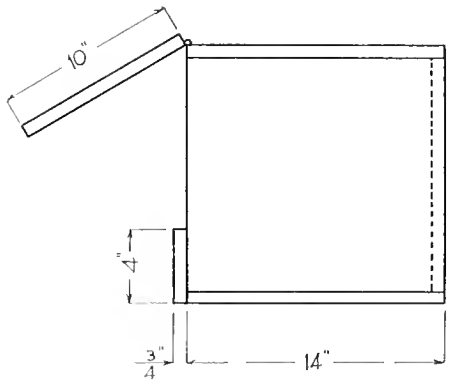
Bill of Stock and Directions. The pupil will make his own bill of stock and outline of procedure.

NEST FOR A SITTING HEN



ROW OF NESTS FOR LAYING HENS





COOPS FOR HENS AND CHICKENS.

Purpose. Chicken coops are needed wherever chickens are raised. This problem will meet with approval in almost any shop. Much time was spent in getting the size which will be best for the hen and chickens, and most economical in lumber.

A-Shaped Coop.

Material. Cheap grade of pine or old lumber of any kind.

One piece 7/8″x12″x10′.
One piece 7/8″x12″x7′.
Two laths or strips 1/2″x1 1/2″x2′6″.
A number of 6d. common nails.

Bill of Stock. Finished dimensions.

(1) Four pieces 7/8″x12″x2′6″ for roof.
(2) Two laths 1/2″x1 1/2″x2′6″ for roof.
(3) One piece 7/8″x12″x3′ for lower back piece.
(4) One piece 7/8″x12″x1′6″ for upper back piece.
(5) One piece each of 7/8″x1 1/2″x3′, 2′6″, 1′11″ and 1′4″ for front strips.
(6) One piece 7/8″x6″x9″ for upper front strip.
(7) Four pieces 7/8″x2 1/2″x2′ for inner cross braces.

Tools. Saws, plane, gage, rule, pencil, T-bevel, and hammer.

Directions. Saw the 10′ board into four pieces 2′6″ long. Set the T-bevel on the square at an angle of 1 1/2″ to 2″. (See illustration on Plate II.) Bevel the ends of the roof boards to the angle set on the T-bevel. Using the same angle saw the back boards mentioned in No. 3 and No. 4 in bill of stock. Also saw out and cut to slant No. 5 and No. 6. Pieces in No. 7 in bill of stock are used merely as nail ties to keep the coop from parting in the middle.

Assembly. Nail the roof boards to the cross ties first. Fit the two parts together and nail at the top. Nail on the lower back piece, then the upper and lastly the front strips, using the measurements shown in the drawing. The laths are to keep rain from running thru the cracks between the two boards. Nail all pieces securely as the coop is likely to be moved often.

Box Coop.

Material. Same wood as in A-shaped coop.

One piece 7/8″x12″x14′.
One piece 7/8″x8″x14′.
Two laths or strips 1/2″x1 1/2″x3′.
A number of 6d. and 8d. common nails.

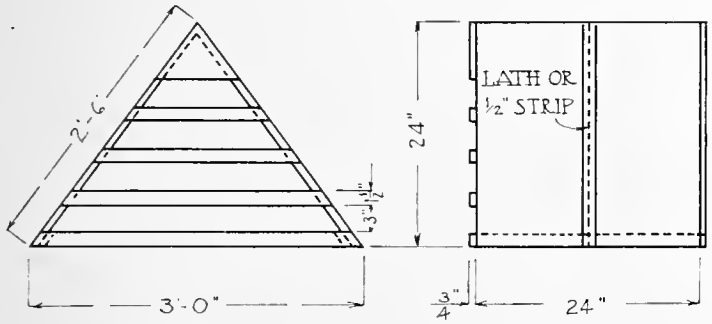
Bill of Stock. The bill of stock may be made out by the pupil. Material may be saved by making piece A from the piece sawed off of the board just below it.

Tools. Same as for A-shaped coop.

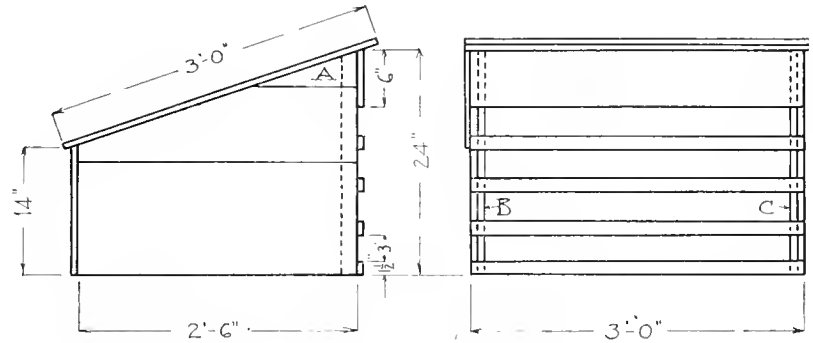
Directions. The board 7/8″ x 12″ x 14′ will make the three roof boards and the lower board on each side. Saw these roof boards to proper lengths. The remaining pieces are made from the 8″ board. A side may be made with the 12″ board mentioned above and the 8″ board. To do this lay the 12″ board and 8″ board together, measure up 14″ from one end and 24″ on the other. Connect these two points and saw the line. Piece A shown in the drawing may be made from the piece just sawed off. The back is made in two pieces as shown in the drawing. Rip out the front pieces.

Assembly. Make the sides first. Nail the two nail ties, B and C, at the front to hold the three pieces together. Do not nail at the back as the back pieces will break joints. Nail the back boards to the sides, then nail on the front strips, spacing them to correspond to the figures in the drawing. To make the roof boards project over the ends somewhat and give a good appearance, spread the roof boards 1/2″ when nailing them on. This 1/2″ crack will be covered by the strips. Give the coop two good coats of paint.

A-SHAPED COOP FOR HEN AND CHICKENS



BOX COOP



WATERING TROUGH, CHICKEN FEEDER, OATS SPROUTER.

Purpose. Much attention is now being given to the scientific raising of chickens. Conveniences are being added that work for the saving of labor and for the health and well being of the poultry. The watering trough is one of the articles that should be found in all yards. It must be small enough to move easily, and constructed in such a way as to be easily cleaned.

The chicken feeder or hopper is an improvement that saves much labor and feed. The feeder designed in the drawing has two compartments, one for grit and the other for ground feed. One side of the roof is nailed on permanently while the other is hinged so that the door may be raised and the stuff put in. The feed and grit works down automatically as it is eaten by the chickens, thus saving the work of many feedings.

This oats sprouter is designed for the purpose of keeping fresh green feed for the chickens all thru the winter. It is built as a stand which holds the trays of oats. The trays are nearly filled with oats which are well moistened. The sprouter is then set by the furnace or stove where it can get plenty of warmth and the sprouting oats are moistened each day. Under proper conditions these grow quickly, and a tray can be used each day, thus affording a daily supply of green feed. The sprouts should be from 4″ to 6″ high before using.

Watering Trough.

Material.

One piece ¾″x8″x7′10″ pine.
A number of 8d. common nails and some white lead.

Bill of Stock. To be made out by the pupil.

Tools. Saws, pencil, plane, try-square, rule and hammer.

Directions. Lay out and finish all pieces as shown in the drawing. Take care to make good joints, planing the edges and ends at each joint. Before nailing put white lead in each joint.

Chicken Feeder.

Material.

One piece ½″x12″x13′ pine.
One piece ½″x10″x7′8″.
One piece ¾″x8″x10′
One piece ¾″x8″x8′.
One pair 1½″ butt hinges, also a number of 6d. and 8d. common nails.

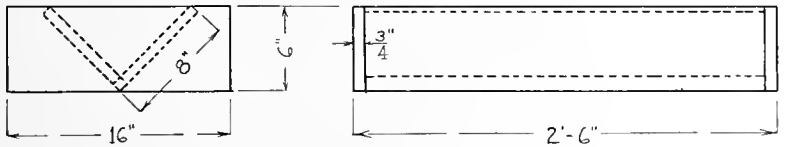
Bill of Stock. The list of materials given above will be ample to complete the problem. Careful thought will show how to put this feeder together with little waste of material.

Tools. Saws, plane, square, try-square, gage and hammer.

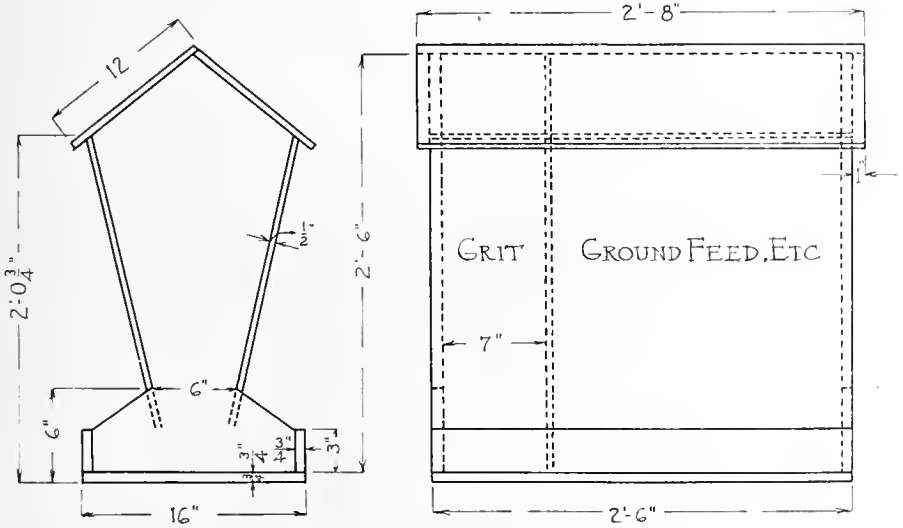
Directions. Make the ends first. Plane a good joint on an edge of two 8″ pieces and put together with corrugated fasteners, using them in the ends as well as sides. Lay out the end as shown in the drawing. From the bottom mark up 3″ and mark points on both edges, again 6″ and draw lines across. Find center and put a point 3″ to each side. Measure up 24″ and mark points on both edges, then find middle of end. Connect all points and saw carefully to line. Mark the partition the same way. Make the bottom or floor of two 8″ boards. The sides of the hopper are made of 12″ and 10″ boards. They need to be notched to fit where the piece extends down into the bottom of the hopper. One roof board may be left full 12″ wide, while the other is cut to 11½″.

Assembly. Nail the bottom and then the 3″ side pieces to the ends and middle partition. Nail on the sides. Nail on one side of the roof permanently. Put hinges on the other piece.

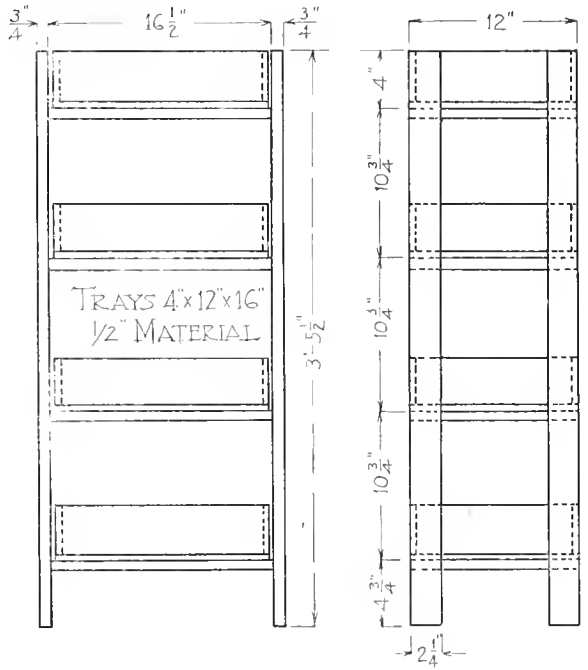
WATERING TROUGH



CHICKEN FEEDER



OATS SPROUTER



Oats Sprouter.

Material.

One piece ¾″x12″x9′ pine.
One piece ½″x12″x12′4″.
A number of 6d. and 8d. common nails.

Before beginning this problem make out the bill of stock. There are twenty-eight pieces with only five different dimensions. Lay out all the material before beginning to saw so as to be sure that you have figured correctly.

CHICKEN CRATE.

Purpose. This chicken crate is for use in hauling chickens to market, moving them from one place to another, or for shipping them by express. Expensive lumber is not needed, and boxes or crates can be used to advantage.

Material. Almost any kind or width of lumber may be used. The floor should be solid, and a good set of boards at least 2¾″ wide should be used around the bottom. The sliding board is cut accurately while the remainder may be almost any width with spaces 2″ or less between strips.

Tools. Saw, hammer, rule, pencil, and chisel.

General Directions. It is not necessary to make out an accurate bill of stock, as only the lengths of the different pieces are required. Make the corner and middle posts first. Cut several pieces to the right length to make the ends, following as nearly as possible the widths shown in the drawing. Make the middle partition. Saw a number of pieces 4′ long for the sides and nail these strips to the ends. Turn the frame upside down and nail on enough ½″ strips to cover the bottom. Saw and nail on the top strips. Chisel out a notch for the sliding center board. Nail on the tin strips at A, B, and C. When the crate is to be fastened permanently a small nail may be driven thru a tin strip and the sliding board.

EGG TESTER.

Purpose. This box is designed to aid in testing or candling eggs. It is nothing more than a box with a hole the size of an egg in the front, a hole in the top for the smoke from a lamp to escape and a hinged door in front thru which the lamp may be admitted. An electric bulb may be used instead of a lamp. The tester is used in a dark room. Light the lamp and place it in the box and hold the egg over the opening in front. A little practice will soon enable the user to tell the condition of the eggs.

Material. Pine.

One piece ½″x8″x5′8″.
One pair small butt hinges.
A number of 6d. finishing nails.

Bill of Stock. Finished dimensions.

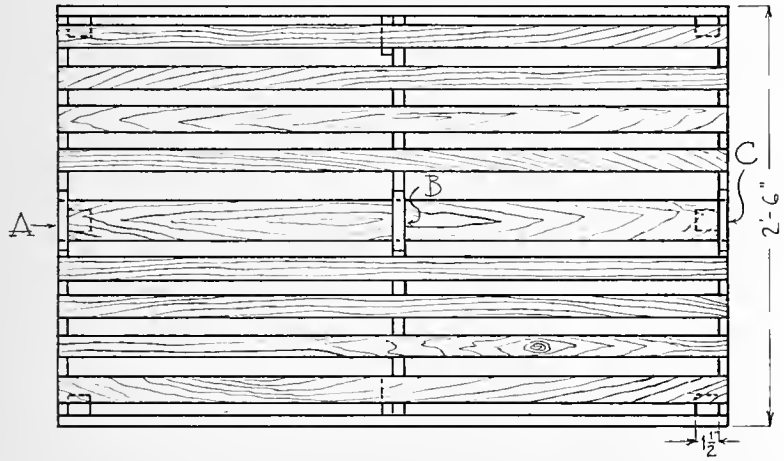
One piece ½″x8″x13″ for back.
Two pieces ½″x7″x13″ for sides.
One piece ½″x8″x8″ for bottom.
One piece ½″x4½″x8″ for top.
One piece ½″x8″x11½″ for door.
One piece ½″x2⅝″x8″ for front lower piece.

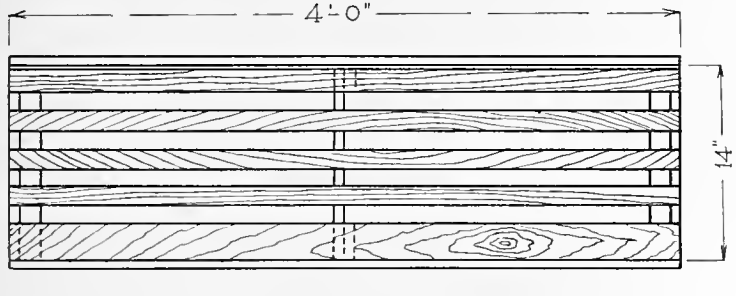
Tools. Saws, plane, gage, rule, pencil, try-square, brace, extension bit, T-bevel and hammer.

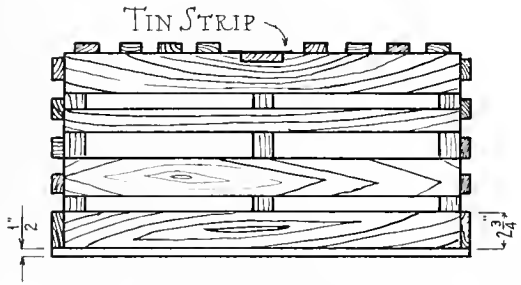
Directions. Saw and plane all pieces to dimensions. To shape the side pieces, measure up on one edge 2½″. Across the opposite end measure in 3¼″ from the corner. Connect these, and saw and plane to the line. Set the T-bevel to this angle just made, and use it in planing the lower front piece, top, and upper end of door. Bore a 1½″ hole in the center of the top board. Bore another 1¼″ hole in the center of the door.

Assembly. Nail the side to the back. Put on the lower front piece then the bottom and top. Lastly, put on the hinges.

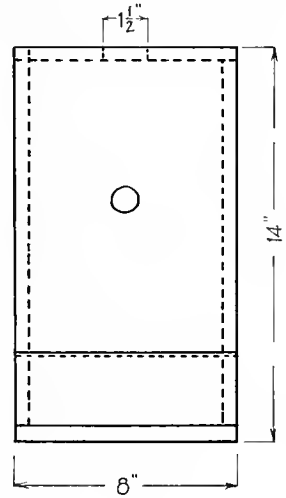
CHICKEN CRATE

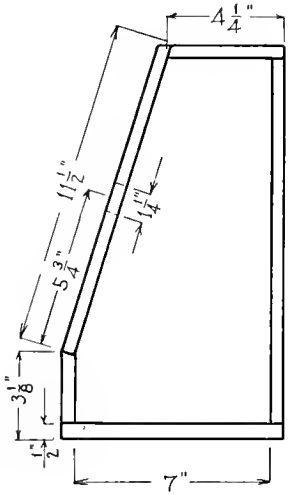






EGG TESTER





ALMOST ANY WIDTH OF LUMBER MAY BE USED. OLD BOXES AND CRATING CAN BE USED TO ADVANTAGE

SEED CORN TESTING TRAY.

Purpose. The seed corn testing tray is one of the most needed and useful articles to be found any where on a farm growing corn in any quantity. The construction of the box is simple. Directions for using are below.

Material. Yellow pine or any comparatively light wood.
One piece ¾″x8″x10′.
Two pieces of cheap muslin about 28″ square.
One piece black chalk. A number of 8d. common nails.

Bill of Stock. The bill of stock will be made out by the pupil.

Tools. Saws, plane, try-square, hammer, yard stick, and rule.

Directions and Assembly. Cut all pieces to the dimensions shown in the drawing. Nail the sides and ends together, and then nail on the bottom. Lay off on one piece of muslin as near as possible to the center, one hundred squares using the yard stick and black chalk in laying off and drawing the lines. Put the numbers of the rows to the outside as shown in the drawing. Fill the box about half full of sawdust pressing it down level all over the box. Lay the piece of muslin with the marked squares over the sawdust in the box. Place your corn to be tested in rows of ten, or one hundred, so that you will know where each ear belongs. Select six grains from different parts of the ear. Lay these six grains in square No. 1, in two rows, pointing in the same direction. Repeat until all the squares are filled. Cover with the second piece of muslin and spread sawdust over this. Moisten well and keep in a warm place four or five days, then remove the top cloth and take note of the experiment. Supposing the grain or grains of ear No. 41 failed to sprout, discard that ear from the row you are testing. Discard also the ears that have weak sprouted grains, or those that have only part of the grain sprouted. The ears of corn left in the row are to be used as seed.

FRAME FOR THE SEED CORN TESTING TRAYS.

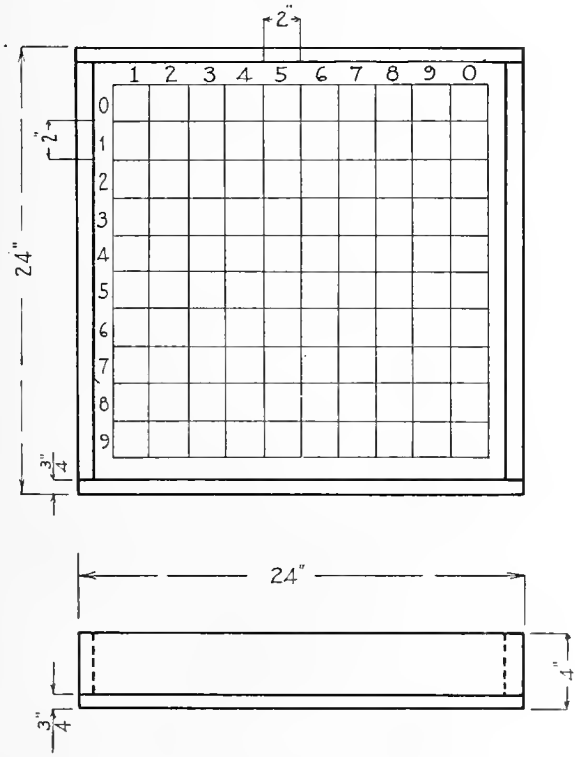
Purpose. This frame makes a convenient place to keep the testing trays while testing corn and it also affords a place to keep them from one year to another. This frame will support six trays. Six trays will be enough for almost any sized farm. Allowing one hundred ears to the bushel, six bushels can be tested at a time.

Material. Yellow pine or any cheap wood.
One piece 2″x4″x7′.
One piece ¾″x6″x12′.
One piece ¾″x6″x8′.
A number of 8d. common nails.

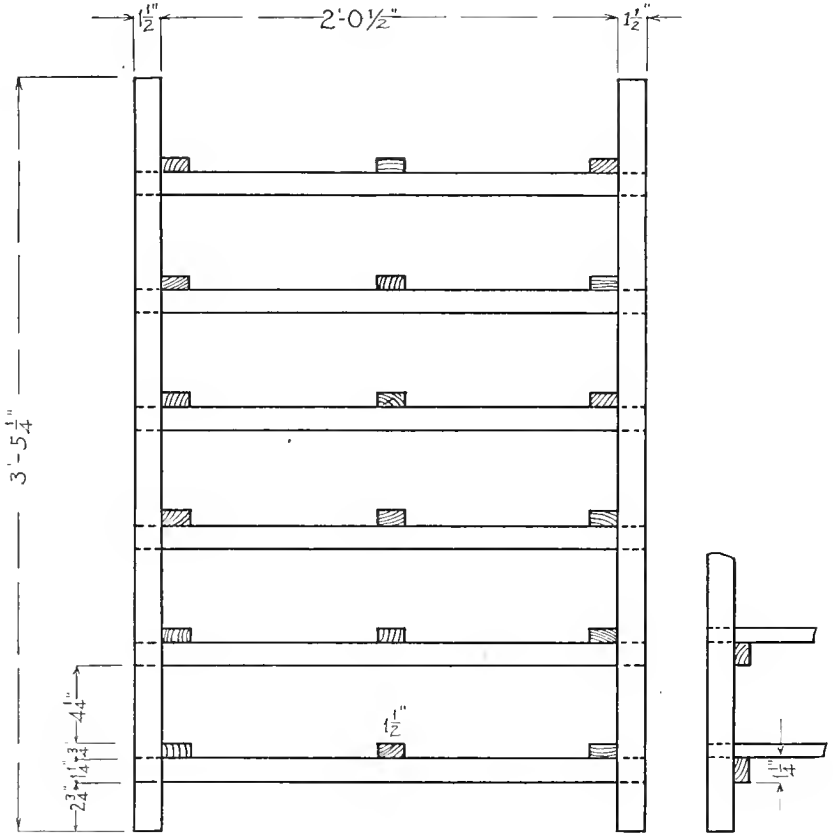
Directions and Assembly. This problem is so simple that almost a glance will show the sizes of pieces, and construction. When assembling the frame, you will find it easier to nail together the braces and pieces for the trays to slide on before nailing them to the posts.

SEED CORN TESTING TRAY

SQUARES AND NUMBERING TO BE DONE ON CLOTH



FRAME FOR SEEDCORN TESTING TRAYS



CORN TRAY FOR EXHIBITION PURPOSES.

Purpose. Corn shows usually have three groups, the best single ear, the best ten ears, and the best fifty ears. Most men usually enter their corn in the ten ear group. It is for this group that this tray has been designed. Nearly every little town and many larger towns in farming districts have their corn shows. The teacher of manual training will have little trouble in getting the Commercial Club of the town to furnish the lumber with which to make the trays, which can be stored and used year after year. This will make a good class problem, each making one or several trays, or the instructor may employ the factory method, allowing the boy to make one or two parts until he is proficient in that part. As a rule the boy who raises corn will want a tray of his own to keep at his home.

Material. White pine.

One piece ½″x12″x2′2″.
One piece ¾″x2½″x2′2″.
Two pieces ¾″x2½″x13″.
One piece half round moulding ½″x8′6″.
A number of 6d. finishing nails and ⅞″ brads.

Bill of Stock. Finished dimensions.

(1) One piece ½″x11½″x2′1½″ for bottom.
(2) Two pieces ¾″x2¼″x12″ for sides.
(3) One piece ¾″x2¼″x2′1½″ for back.
(4) Nine pieces half round ½″x11¼″.

Tools. Saws, planes, plow, try-square, rule, pencil, gage, and hammer.

Directions. Put a ⅝″ blade in the plow and set it to cut ¼″ deep. Plow out a groove in the bottom piece leaving a strip ½″ wide between the edge and the groove. After the pieces mentioned in Nos. 2 and 3 in bill of stock have been planed to dimensions, a groove ½″ wide and ¼″ deep is plowed along one edge leaving ¼″ between the edge and the groove. Lay out the joint as shown in the detail. Take notice that the grooves on the end pieces should face each other, and they must fit the groove in the back piece.

Assembly. Nail a side and back piece together. Fit in the bottom board and then fit the opposite side piece, being sure that all joints fit before nailing permanently. Saw the half round to proper lengths, space them equally and nail with small brads.

CRATES FOR CORN IN EAR.

Purpose. This crate is made especially for handling seed corn although it can be used for ear corn generally.

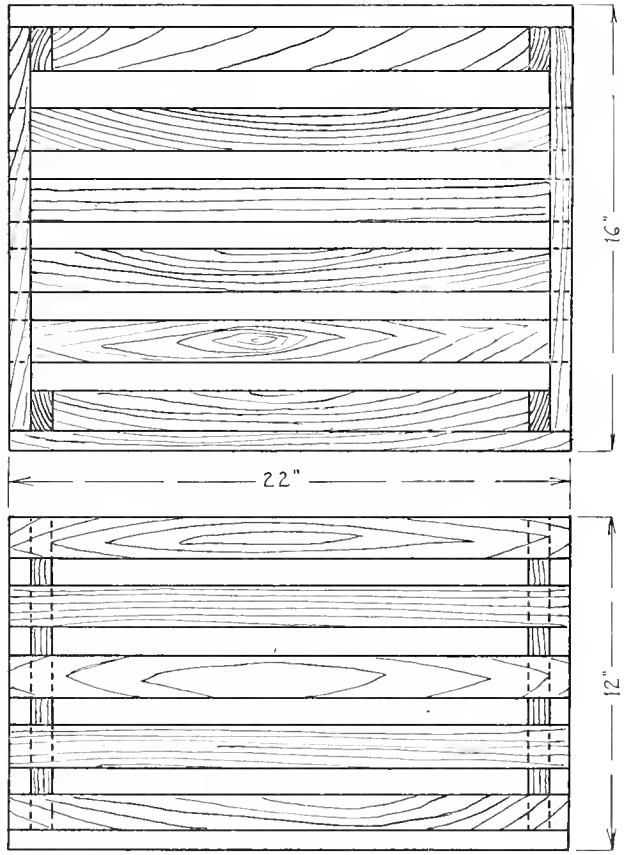
Material. Rough sawed lumber of almost any light wood, crating lumber being most economical. A number of 6d. common nails.

Tools. Saws, gage, square, rule, pencil and hammer.

Directions and Assembly. Rip out all pieces and saw to correct dimensions as shown in drawing. Nail the end pieces to the upright pieces, spacing as nearly equally as possible, and using five pieces to the end. Nail on the bottom, putting on six pieces and lastly, the ten side pieces using five to each side.

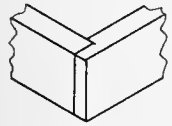
CRATES FOR CORN IN EAR

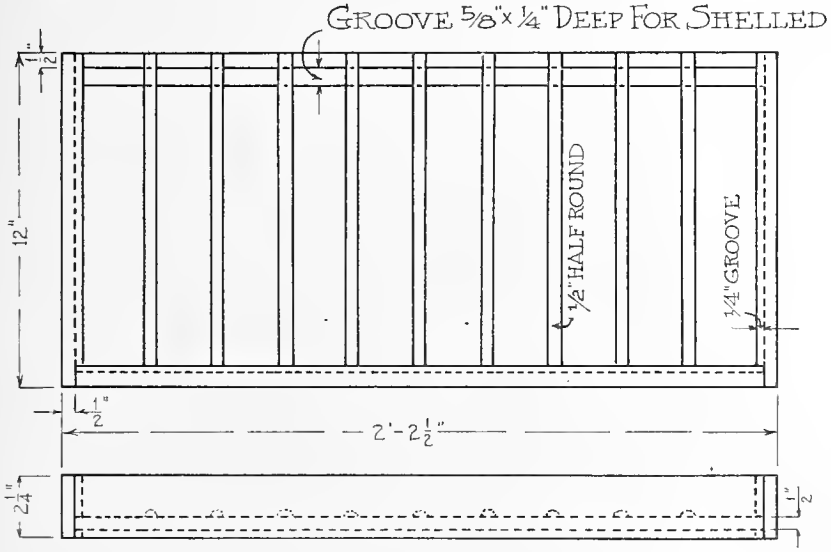
ALL MATERIAL ¾" x 1½"



CORN TRAY

FOR EXHIBITION PURPOSES





SEED CORN RACK.

Purpose. This seed corn rack is the most convenient, the most practical, and the cheapest rack that can be constructed. It is coming to be a potent factor of farm equipment. Our up-to-date farmers have learned the need of keeping seed corn high and dry, and so arranged that air can circulate freely around each ear. In this rack the corn ears are laid on the wire shelves, the ends projecting on each side. The height and width of the rack may be varied according to the individual needs. As given here the rack holds about twenty bushels of corn, and the cost of construction is comparatively very low.

Material.

Three pieces 2″x4″x10′
Seven pieces 2″x4″x8′.
750 ft. No. 12 gage wire and a number of 10d. and 20d. common nails, also a number of staples.

Bill of Stock. Finished dimensions.

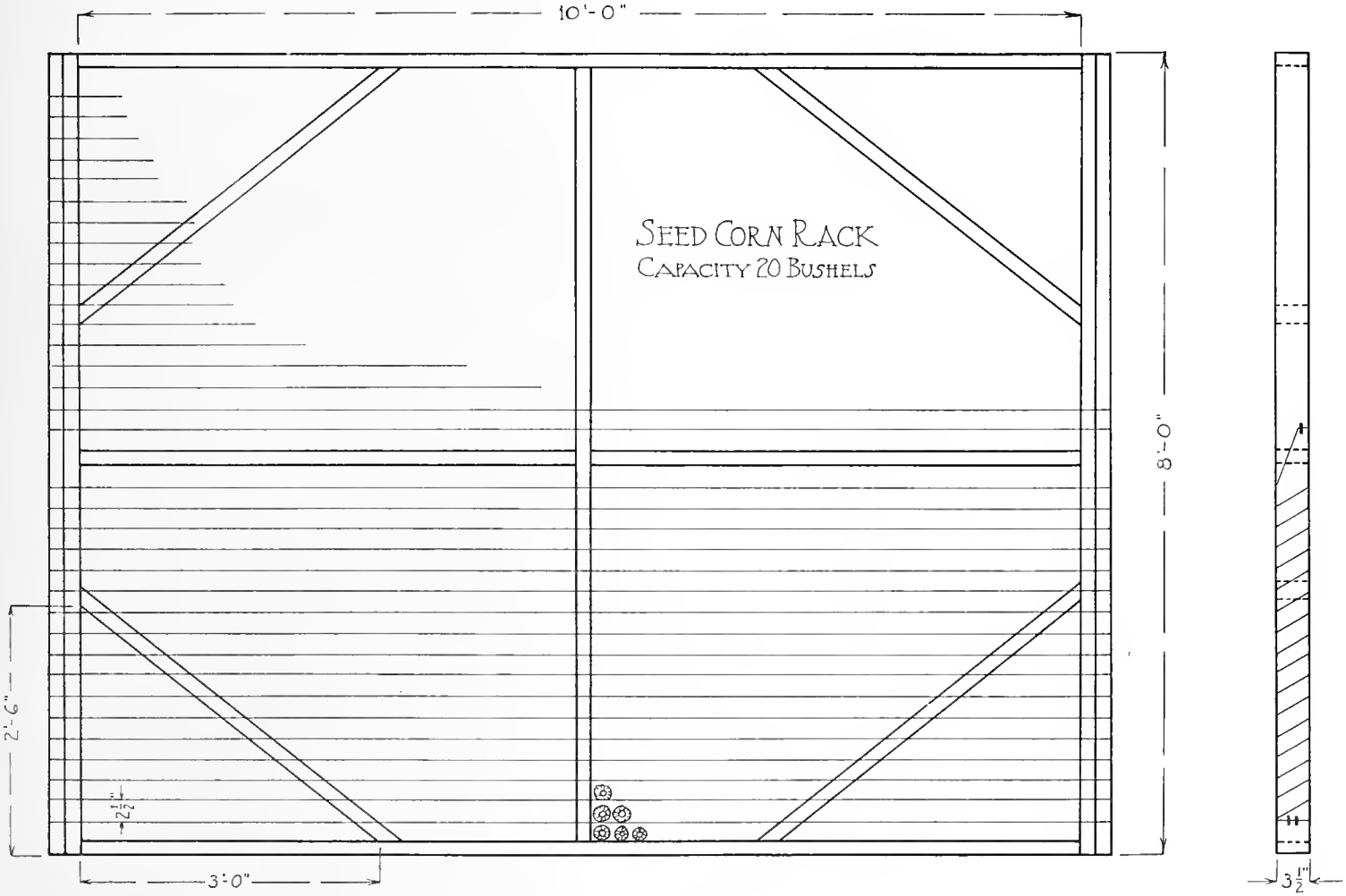
(1) Two pieces 2″x4″x10′ for upper and lower pieces.
(2) Four pieces 2″x4″x8′ for double ends.
(3) One piece 2″x4″x7′8½″ for middle upright.
(4) Two pieces 2″x4″x4′11⅛″ for middle lengthwise braces.
(5) Four pieces 2″x4″x4′ for corner braces.

Tools. Saws, square, rule, pencil, T-bevel, hammer and pliers.

Directions. Measure and cut Nos. 1, 2, 3, 4, mentioned in the bill of stock. Miter the brace, using 10″ on one arm of the framing square, and 12″ on the other to get one angle. Reverse this to get angle at other end.

Assembly. Lay on the floor the two 10′ pieces; nail one 8′ piece at each end. Put in the middle upright piece, then the two cross braces. Nail on the extra 8′ pieces at the ends. Put in the mitered braces. The most difficult step in making this rack is to get the wires evenly stretched. Stand the rack upright on the floor and nail temporarily, adding other braces in such a way that they will give stability and at the same time be out of the way as much as possible. Mark off distance between wires at each end. Two men will be required to do the work. Unroll the wire only as needed. At one end put in enough staples to hold firmly, bending over the wire as an extra precaution. One person, by using a large pair of pliers and bracing himself against the rack, can stretch the wires tightly while the other person puts in the staples. When the work gets too high to reach easily, turn over the rack and work downward.

PLATE 16



CABINET FOR SEEDS AND SMALL GRAIN.

Purpose. Farmers have always been at a disadvantage in storing for another season's planting, the seeds and small grain that they wish to keep. They have been stored in sacks and paper bags, and hung from the ceiling in the barns and attics, only to suffer from rats and mice and weather conditions. Or they are sometimes hung in the kitchen, proving a dust catch and a source of much care. This seed cabinet will care for all the seeds and small grains for the farm and garden, keeping them dry and safe from mice and rats. The metal used in each section does not absorb or give off moisture. This cabinet can be used in schools where agriculture is taught. If a larger cabinet is desired, it can be made higher or longer, and more sections added. Each drawer will conveniently hold two-thirds of a peck.

Material.

One piece ¾″x12″x10′.
Two pieces ¾″x8″x12′.
One piece ¾″x8″x10′.
One piece ¾″x10″x10′.
One piece ¾″x10″x14′.
One piece ½″x8″x18′.
Twenty-five pieces No. 28 gage galvanized iron 15″x17″, also a number of 6d. and 8d. finishing nails and small sized shingle nails. (Not galvanized.)

Bill of Stock. Finished dimensions.

One piece ¾″x17″x4′4¼″ for top.
Two pieces ¾″x15¼″x2′6¾″ for sides.
One piece ½″x2′6¾″x4′1¾″ for back.
One piece ¾″x2″x3′11¼″ for horizontal casing.
Five pieces ¾″x1½″x3′11¼″ for horizontal casings.
Two pieces ¾″x1½″x2′6¾″ for vertical casings.
Twenty pieces ¾″x2½″x14¾″ for drawer runners.
Forty pieces ¾″x1½″x14¾″ for drawer runners.
Ten pieces ¾″x¾″x14¾″ for drawer runners.
Twenty pieces ¾″x1½″x4¼″ for vertical casings.
Twenty-five pieces ¾″x5″x9½″ for drawer fronts.
Twenty-five pieces ½″x4″x8″ for rear of drawers.
Sixteen pieces ¾″x2″x4¼″ for frame at F in drawing.
Four pieces ¾″x2″x2¾″ for frame at G in drawing.

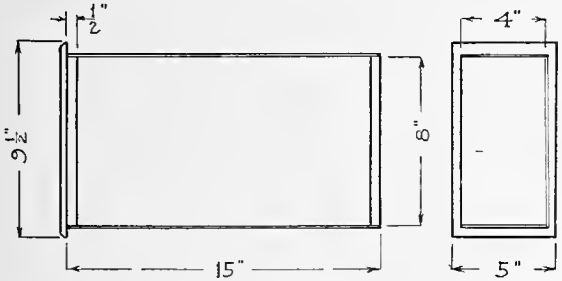
Tools. Saws, planes, hammer, square, try-square, rule, pencil, mallet, plow, chisel and nailset.

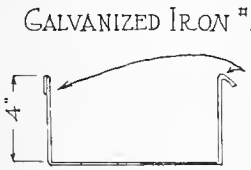
Directions. Get out stock for ends and top, and glue them together. Finish to dimensions given in the drawing. Plow out insides of end pieces at back as shown in detail of corner in drawing. Cut to dimensions all pieces called for in bill of stock, making the larger pieces first, as in this case nearly any small piece may be used. With the plow, saw and chisel cut the face of all the drawers. Round up outside edges with plane. Bend galvanized iron as shown in detail of drawing. This ½″ lap makes a stiffer drawer and at the same time rounds the edge so that it will not cut the hands. Put in the ½″ x 4″ x 8″ piece of wood and nail the three pieces together. Nail the various drawer runners together as shown at A, B, C.

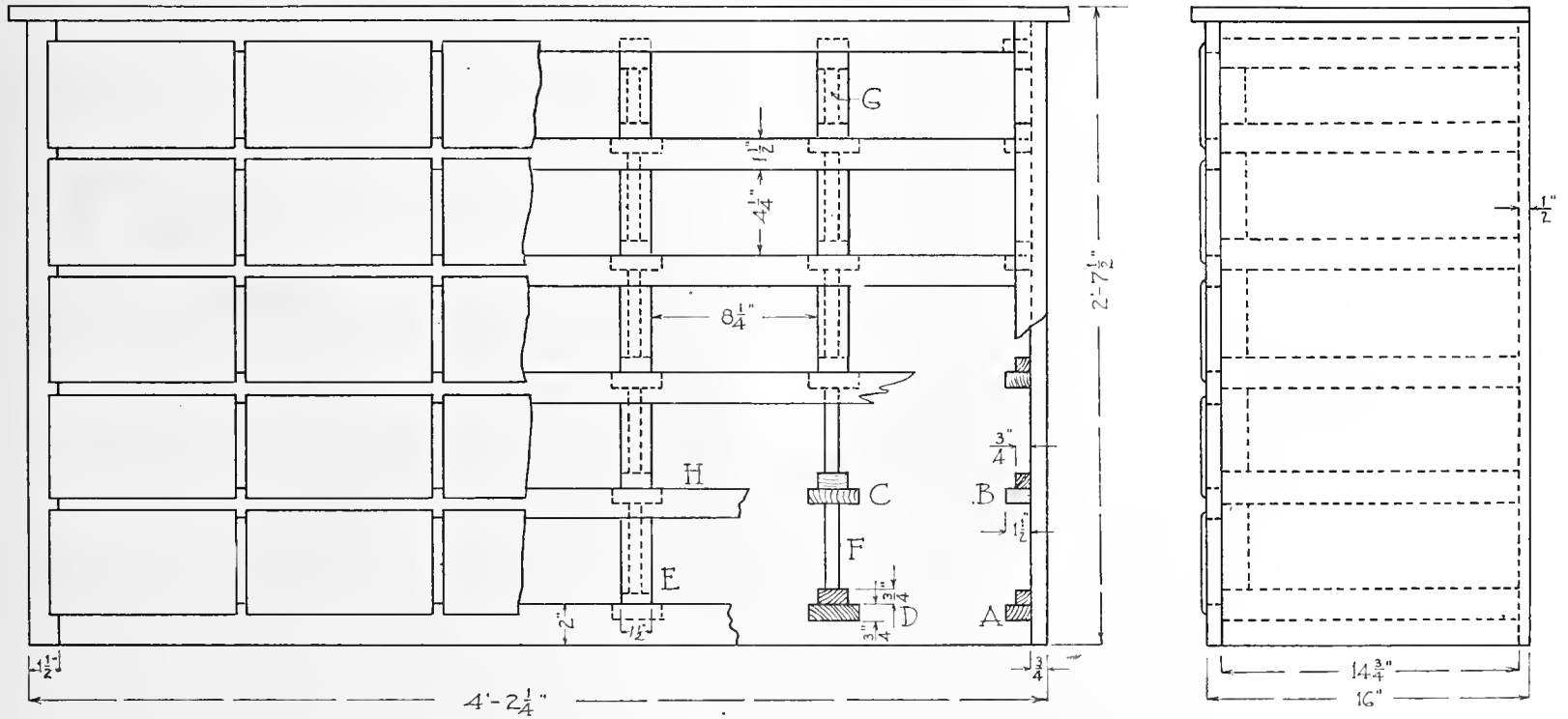
Assembly. Lay off and nail on A, B, etc. on the inside of both ends. Nail in the half-inch boards at the back. Put on lower 2″ casing, and fit and nail in drawer runners marked D in drawing. Toe-nail pieces marked F, to D, etc. Now you are ready for a new addition to the frame. Nail on to the ends as at B, the horizontal casing marked H. Now nail in C, etc., at both front and back. Proceed as before until all have been put in. Put on the top. The drawer openings are made large so that the drawer opens easily without handles.

PLATE 17

CABINET FOR SEEDS AND SMALL GRAIN







SEED CORN SLED.

Purpose. Years ago, before much attention was given to the selection of seed corn, it was a common practice for the farmer to go to his corn crib at planting time and pick out what he considered his best ears of corn. A better practice was to select the best ears of corn as it was husked. Agriculturists having since given the problem considerable thought and experiment, have proved this to be a very poor method. In selecting the best seed corn it is necessary to know not only the size and shape of the ear, and the kind of grains on the ear, but also the height and thickness of the stalk, its color and appearance as to sturdiness, the hang of the ear, and the amount of husks covering the ear. They have also found that the best seed corn is picked early, before the regular time for husking. This necessitates going thru the rows of corn without injuring the rows. The narrow seed corn sled in the drawing is designed for that purpose, and it has proved to be a success. One horse is hitched to the sled and it is dragged thru the rows of corn, as the ears of corn are husked and thrown into the sled. When the sled is filled and hauled to the barn the side door is unloosed and the sled tipped over to empty the contents. These ears of corn are the choice ears of the field, but they need to be given the regular seed corn test before planting. It is not necessary to make this sled of new material, and in fact for economy's sake, it is better to use old lumber. If the lumber you have on hand does not conform to these dimensions, make your own measurements, merely using this as a guide.

Material. Yellow pine.

One piece 2″x8″x14′6″.
Three pieces 2″x4″x8′.
Five pieces ¾″x6″x14′.
One piece ¾″x6″x16′.
One pair T-hinges and screws.
Two hooks or hasps with staples.
Six feet of ⅜″ round Norway iron.
One 2½″ iron ring made from ½″ stock.
A number of 20d., 8d., and 6d. common nails.

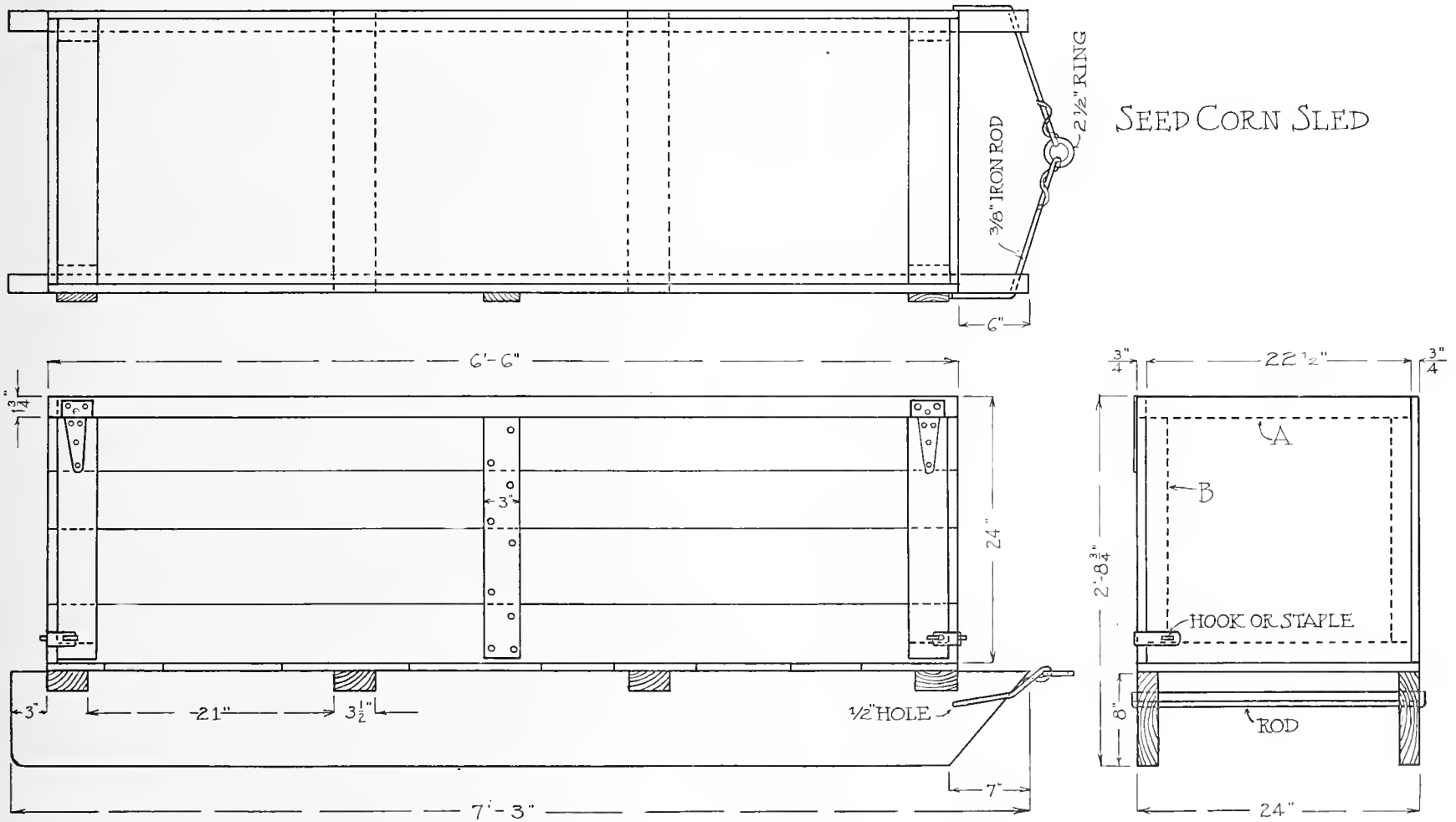
Bill of Stock. The pupil should make out his own bill of stock. As this is generally made of old and uneven material, it will give the workman a chance to use his ingenuity in working in odd pieces. It is not necessary that these exact dimensions be used if it will suit the workman's convenience to use other measurements.

Tools. Saws, plane, chisel, square, try-square, rule, pencil, brace, ½″ bit, screw-driver and hammer.

Directions. Saw out the two runners to lengths given in the drawing. Measure back 7″ on one edge at one end; draw a line to opposite corner and saw to line. At the opposite end measure in 3″ and then 3½″, and saw down 1¾″ enough to let a piece of studding come flush with the surface. Lay out, saw and chisel the three other notches. Bore a ½″ hole in the front end at about the position shown in the drawing. Saw and cut to dimensions all other pieces.

Assembly. Nail in, with 20d. common nails, the pieces of studding which fit into the notches and form the cross ties of the sled. Using any width of boards, place and nail onto this framework the floor, filling out the 6′6″ length of the floor of the sled. Nail together the pieces of studding marked A and B in the drawing. Nail these frames to the floor, placing one ¾″ from each end to allow for the end boards. Nail on the end pieces, and then the back. Nail on the strip above the door, and screw on the hinges. Make the door, being sure that the end strips come over the end frames and in position to be used for the hinges. The third strip is put on in the middle. The door is held at the bottom by bent hooks or hasps as shown in the drawing. In the forge shop make a 2½″ ring from ½″ stock. Slip the rod mentioned in the list of materials thru the holes already in the runners and bend it around. Place the ring in the center and bend over the rod enough to keep it from slipping when the sled is heavily loaded.

PLATE 18



SEED CORN SLED

BIRD HOUSES.

Purpose. Every agricultural department of every state, most farmers, and in general most people, are beginning to understand that birds are a great asset to the country, not only for their economic value, but for their beautiful plumage and songs. They are interesting to study because of their home life, their habits, and almost human intelligence in making their nests and providing for and teaching their young. The forests and trees, prairies, marshes, and natural meadows that in the early times were the natural nesting places for birds are being taken from them. The marshes are being drained, prairies farmed, the grass from meadows is being cut or grazed, forests are being cut down, thus driving out the birds to the extent that some kinds are becoming extinct. It is to give some of our best birds a nesting palce that so many people are taking it upon themselves to build homes for them. In the elementary grades will be found boys who can give time to making several bird nests during manual training periods, and they would soon dot the country over with homes for the birds. On the plate here shown are four houses, one designed for a chickadee, one for a tree swallow, another for two families of house wrens, and a fourth for a colony of martins. The chickadee house should be placed 6 to 15 feet from the ground, tree swallow house 10 to 15 feet, house wren 6 to 10 feet, and martin 15 to 20 feet.

CHICKADEE HOUSE.

Material.

One piece ½″ x 12″ x 3′.
A number of 1¼″ finishing nails.

Bill of Stock. Finished dimensions.

One piece ½″ x 5″ x 13½″ for back.
One piece ½″ x 7″ x 5¾″ for top.
Two pieces ½″ x 4″ x 11½″ for sides.
One piece ½″ x 5″ x 10¼″ for front.
One piece ½″ x 5″ x 6″ for bottom.

Tools. Saws, plane, T-bevel, try-square, hammer, brace, extension bit, rule, and pencil.

Directions. Saw the boards to dimensions given in the bill of stock. Set T-bevel on the square at an agle of 1½″ to 4½″ as shown in illustration in Plate II. Use this same angle for cutting front, sides, and roof. Plane down the front piece to 10″ plus the angle on the T-bevel. Use this longer measurement for making the point on the side pieces. From these points on the side pieces extend the lines at angle of T-bevel. Saw and plane to this line giving slant for roof. Cut back end of roof at same angle reversed. Bore 1⅛″ hole in the center of the front 8″ up from the lower end.

Assembly. Nail front piece to sides. Nail back piece, then floor and roof.

TREE SWALLOW HOUSE.

Material.

One piece ½″ x 6′ x 3′4″.
A number of 1¼″ finishing nails.

Bill of Stock. Finished dimensions.

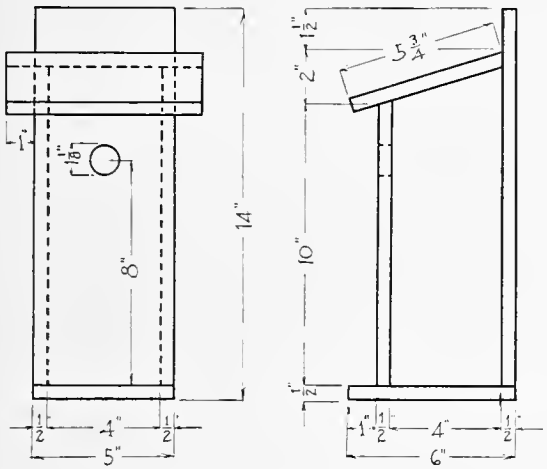
One piece ½″ x 6″ x 11″ for back.
One piece ½″ x 6″ x 7½″ for front.
Two pieces ½″ x 5″ x 6¼″ for sides.
One piece ½″ x 6″ x 6¾″ for bottom.
Two pieces ½″ x 5″ x 6¾″ for roof.

Tools. Same as for chickadee house.

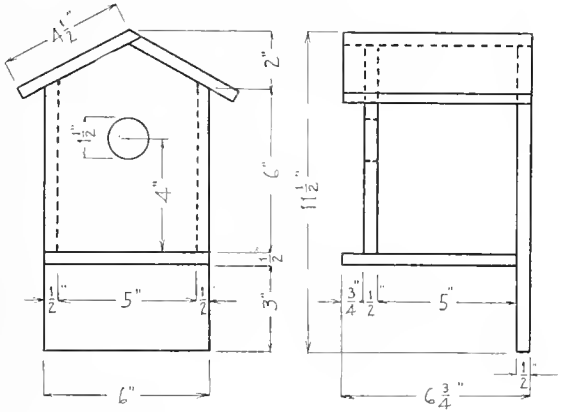
Directions. Cut from the board mentioned in list of material all pieces mentioned in bill of stock. Set T-bevel at an angle on the square of 1½″ to 3″. Use this same angle for all pieces. To make back piece, measure up from one end of board 9½″. Mark a point on each edge of the board. Set T-bevel to these points and draw lines giving the roof

BIRD HOUSES

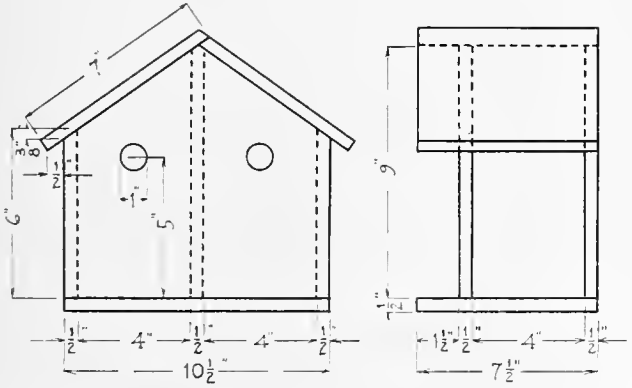
CHICKADEE



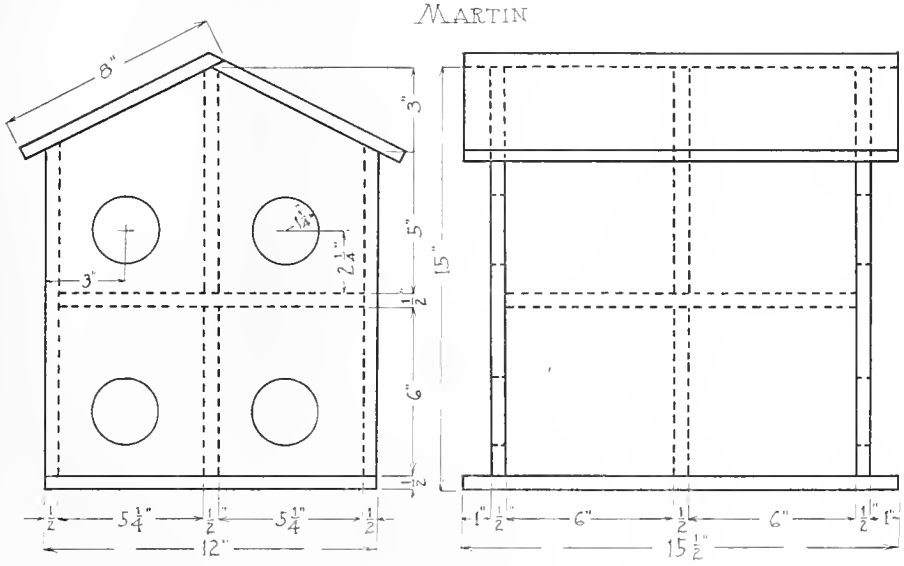
TREE SWALLOW



HOUSE WREN



MARTIN



slant. Cut to these lines. Make front piece in same manner except that points are marked only 6″ high. Set extension bit to 1½″ diameter and bore hole in center of front piece 4″ from lower end. For side pieces measure 6″ from ends, set T-bevel, mark slant, draw lines around pieces, saw to lines, and plane. Bevel one edge of each roof piece. Plane pieces to desired width. The length from ridge to eaves is 4½″.

Assembly. Nail front pieces to sides. Nail back, then floor, then roof pieces.

HOUSE WREN.

The pupil may make out his own list of materials, bill of stock, list of tools needed, and line of procedure. If any question arises the pervious problems may be referred to.

MARTIN HOUSE.

Material.

One piece ½″ x 12″ x 7′.
One piece ½″ x 8″ x 4′7″.
One piece ½″ x 6″ x 2′.

Bill of Stock. A full set of dimensions is given in the drawing so that the pupil may easily work out his own bill of stock.

Tools. Same as in previous problems.

Directions. Cut material up into pieces shown in drawing. Set T-bevel on the square to an angle of 3″ to 6″. (See illustration Plate II, and use this same angle for all pieces.)

For the two fronts, measure 11½″ from end, and mark a point on each edge of the board. Draw lines giving roof pitch. Saw and plane to lines. To locate center point for openings, draw lines, one 2¼″ and one 8¾″ from the lower edge. Measure in 3″ from the edge on each of these lines. On these points bore 2½″ holes. Bevel side pieces to 11″ plus angle on the bevel. To make the central partition fit into roof ridge, bevel edges to the angle given. Bevel roof pieces at the same angle.

Assembly. Nail front pieces to sides; then nail on first floor. Nail in partition boards as follows: lower lengthwise partition, two cross partitions, second floor, upper lengthwise partition, upper cross partitions, and finally the roof pieces.

FRAME FOR HAMMOCK.

Purpose. This convenient frame makes it possible to hang the hammock in any shady spot in the yard, on the porch or on the porch roof, without the necessity of setting posts or using trees. In smaller proportions this hammock frame is most convenient to use in the house, for a baby's or a small child's bed, or swinging hammock.

Material. Yellow pine or hemlock.

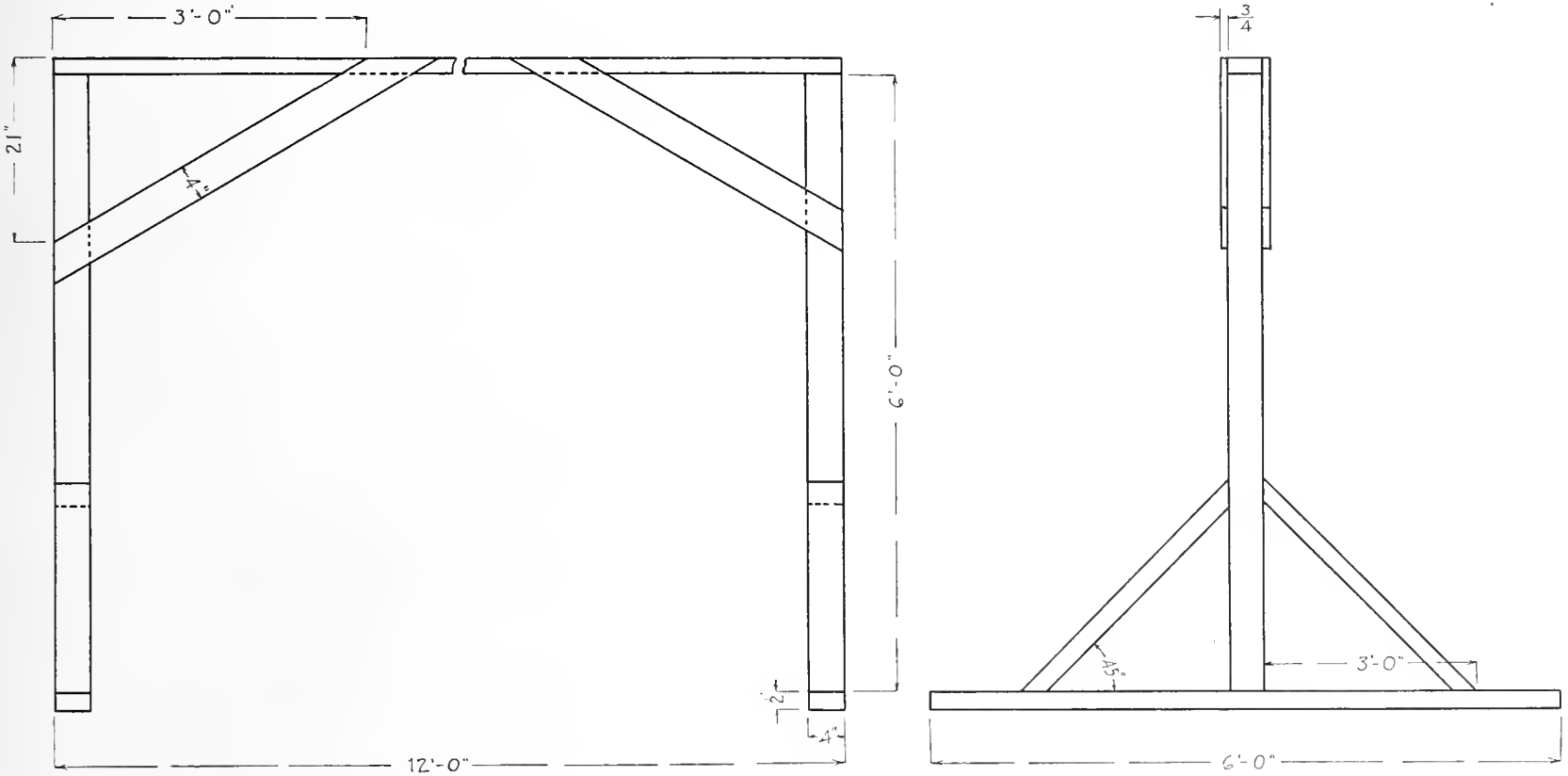
Three pieces 2″x4″x12′.
One piece 4″x4″x12′.
One piece ¾″x4″x16′.

Bill of Stock. The bill of stock may be made out by the pupil. Material may be saved by carefully laying out and sawing joints so that the same sawing in some cases will make the ends for two pieces.

Tools. Saw, plane, square, pencil and hammer.

Directions. Saw all pieces to the lengths shown in the drawing. Miter the lower braces at an angle of 45°, the long side being 2′ 10″ long. In marking out the angle of the upper braces use 7″ on one arm of the square and 12″ on the other, and the reverse to get the angle at the opposite end; the longest edge is 3′ 8″.

FRAME FOR HAMMOCK



Assembly. Nail the 2x4's forming the base of the frame to the 4x4's forming the uprights with 16d. nails. Place and nail the 2x4's forming the braces to the uprights with 10d. nails. Nail on the horizontal beam with 16d. nails, and lastly the four upper braces with 8d. nails.

GATES.

Purpose. A farm gate, garden or yard gate affords an excellent problem for the pupil, and a most useful article after it is made. The large gate is designed especially for the farm and it is wide enough to allow the largest load of hay to pass through easily.

Gate No. 1.

Material. Pine.

Seven pieces ¾″x6″x16′.
Six pieces ¾″x6″x14′.
Six dozen 2½″ bolts $\frac{5}{16}$″ in diameter.
One pair wrought steel strap hinges with bolts and screw.
Some 8d. common nails.

Bill of Stock. The pupil will find it to his advantage to make out his own bill of stock. Directions for measuring and sawing the braces will be given below.

Tools. Saws, plane, square, rule, pencil, brace, $\frac{5}{16}$″ and ½″ bits, and hammer.

Directions and Assembling. Saw the long pieces, end and middle pieces to dimensions. Lay down three upright pieces, and place on these the long strips spaced to dimensions shown in the end view of the drawing. Drive in a nail at each joint to hold the boards in place, and then bore the holes and put in the bolts. You are now ready to saw the braces. Take actual measurements on the individual boards in each case so as to insure good joints. The kind shown in the drawing will serve as a good type, as it gives plenty of room for the bolts in each case. As you cut out a brace fasten it on with small nails. When the braces for both sides have been put on bore the holes and bolt as before. With short ends that have been left over, splice out the boards under the hinges and nail securely and then bolt on the hinges.

Gate No. 2.

Material. Pine.

One piece 2″x4″x10′.
One piece ⅞″x12″x8′4″.
A number of 8d. nails.

Bill of Stock. To be made by the pupil.

Tools. Saws, plane, spokeshave, try-square, rule, compass, pencil, and hammer.

Directions. Cut cross ties and pickets to dimensions given in the drawing. To shape the pickets set the compass to 2¾″, measure down 2½″ from the top end of each picket, and with the try-square draw a line across. Using each end of this line as a center describe arcs. With saw and spokeshave shape down to the lines.

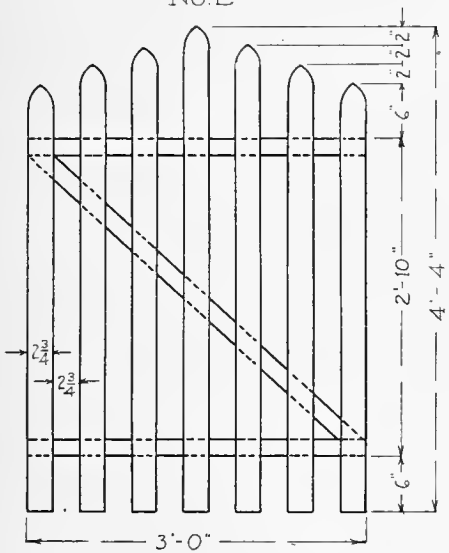
Assembly. Place the two cross ties on the floor the proper distance apart. Place on these the pickets, properly spaced, and nail. To make brace take actual measurement from the gate. Saw out and nail.

Gate No. 3.

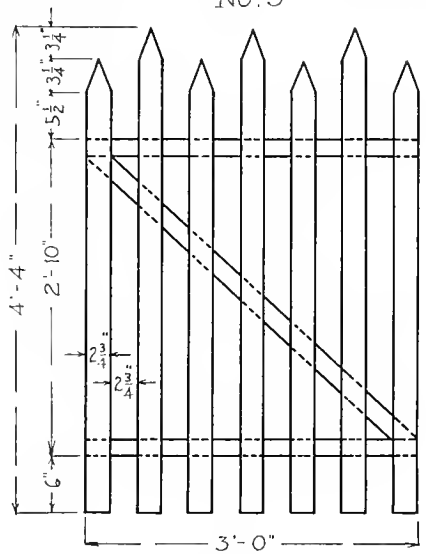
Gate No. 3 is identical with Gate No. 2, the height, width and general dimensions being the same. The only difference is in the design of the picket which may easily be worked out by the student.

GATES

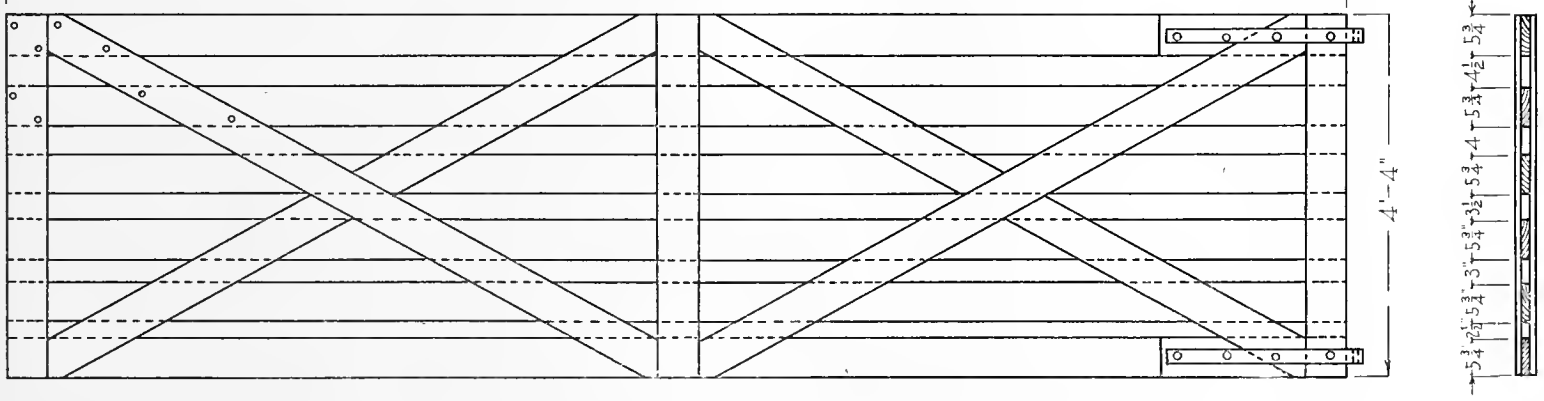
No. 2



No. 3



No. 1



FLIGHT OF STEPS.

Purpose. A good solid flight of steps is often needed in many places about the home. This flight is easy of construction, and by changing the measurements it can be made to fit any definite place or purpose.

Material.

Two pieces 2″x10″x10′ pine.
One piece ⅞″x10″x8′.
One piece ⅞″x8″x14′.
One piece ⅞″x6″x14′.
One piece ⅞″x6″x 8′.
One piece 4″ ceiling 8′ long.
A number of 16d. and 8d. common nails, also 6d. casing nails.

Bill of Stock. Finished dimensions.

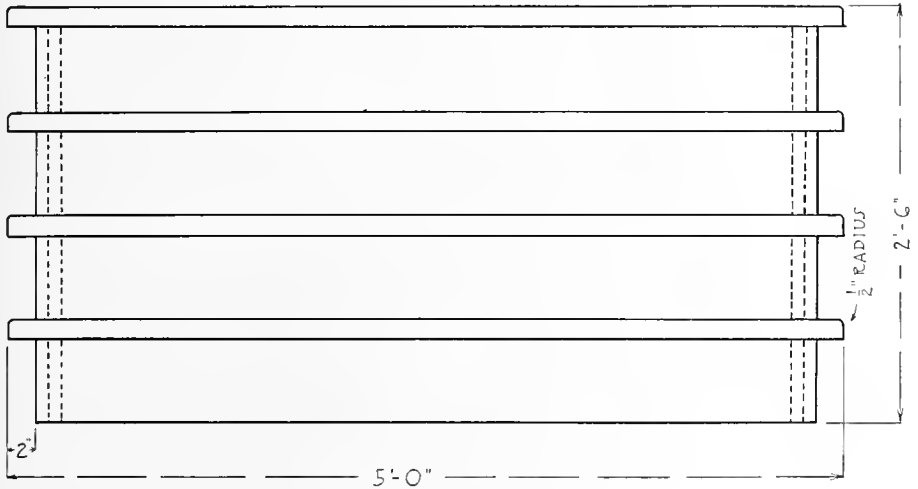
(1) Four pieces 2″x10″x5′ for treads.
(2) Two pieces ⅞″x10″x3′9″ for carriage.
(3) Three pieces ⅞″x7½″x4′8″ for risers.
(4) One piece ⅞″x5½″x4′8″ for bottom riser.
(5) Two pieces ⅞″x5½″x17″ for outside braces.
(6) Two pieces ⅞″x5½″x2′3½″ for outside lower braces.
(7) Two pieces ⅞″x5½″x2′4″ for inside upper braces.
(8) Two pieces ⅞″x5″x2′4″ for inside lower braces.
(9) Ten pieces ceiling, two of each as follows: 14″, 11″, 9″, 6″, and 4″.

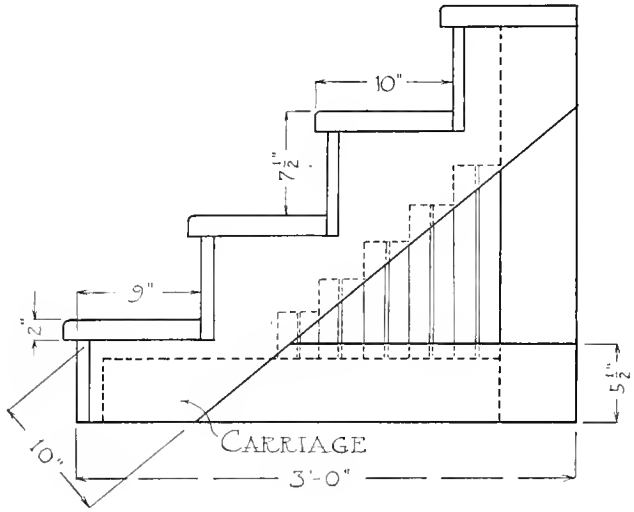
Tools. Saws, planes, square, try-square, T-bevel, and hammer.

Directions. Saw to dimensions all pieces mentioned in the bill of stock. Round off treads ½″ on the corners as shown in the drawing. Lay out and saw boards No. 2 in the bill of stock. To mark the carriage use the large square at an angle of 7½″ by 9″. The height of each riser is the same, but the first one must be cut 2″ narrower, or the thickness of the tread. Mark off the slant on the back and lower outside braces to fit the carriage, or support for the treads and risers. Saw the pieces of ceiling to the lengths given in the bill of stock. The inner braces may be any suitable width and of old material.

Assembly. Nail the back and lower inside braces to the carriage. Now nail on the outer braces flush with the piece supporting the treads. Nail on the pieces of ceiling beginning with the longest pieces at the back and working toward the front. When both ends have been completed put on the risers. Lastly put on the treads.

A FLIGHT OF STEPS





SAW BUCK.

Purpose. An excellent article which, with a good saw and a few sticks of wood, will bring sweat to the brow and good red blood into the viens. The height of the buck may be changed to suit the height of the workman. To find the correct height, place an ordinary stick of cord wood on some elevation, take a good sawing position with the knee on the stick. A few trials will give the correct height. Strength and stability are two other requirements.

Material.

One piece 1¾″x3½″x9′8″.
One piece 1¼″x1¼″x18¾″.
One piece ⅞″x12″x18″.
A number of 8d. common nails.

Bill of Stock. Finished dimensions.
Four pieces 1¾″x3½″x2′5″ for legs.
One piece 1¼″x1¼″x18¾″ for cylinder.
Three pieces ⅞″x2″x17¾″ for braces.
One piece ⅞″x3″x17¾″ for brace.

Tools. Saws, plane, brace, 1¼″, bit or extension bit set to 1¼″ diameter, chisel, hammer, T-bevel, try-square, rule and knife.

Directions. Set T-bevel to an angle of 13½″ x 11¼″ on the square. (See illustration, Plate II.) Mark off and cut the four legs. Measure down 11½″ from the upper end of each leg and bore holes. Lay two legs down on bench, the holes in direct line, spread bottoms until 22½″ apart at outer edges and mark the joints with a knife. Cut these joints down ¾″ deep. Work the other two legs in same manner. Round up 1¼″ square stick to diameter of 1¼″. Cut other pieces to dimensions given in bill of stock.

Assembly. Fit legs together and nail. Put in round piece connecting the two pairs of legs. Bevel pieces directly under round piece to fit, and nail. Put on lower brace up from floor some distance and nail.

RABBIT TRAP.

Purpose. The happiest time in a boys life is during those years when he lives closest to nature, tramping thru the woods, hunting, fishing, trapping, and having a good time generally. There are many rabbit traps, but the author has found this to be the best trap made. The small isometric sketch shows the trap set. It is baited with corn, cabbage, or apple, the bait being placed behind the notched stick or trigger. In getting the bait the rabbit must touch the trigger which releases the door and lets it fall down behind the rabbit. Most boys know where to set the trap, in the orchard, garden, berry patch or thicket.

Material.

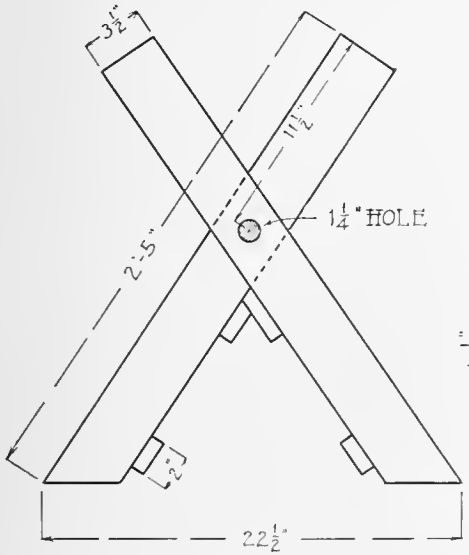
One piece ¾″x6″x8′8″ pine.
One dowel or straight stick ⅜″ diameter and 25″ long.
A number of 8d. common nails, 1¼″ finishing nails, some stout cord, and a screw eye.

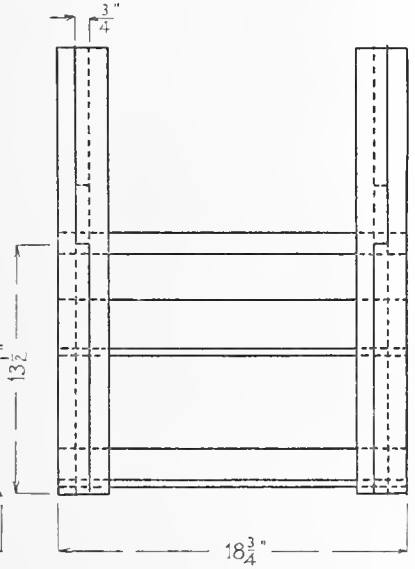
Bill of Stock. The boy will find it best to make out his own bill of stock and in this way may be able to change the dimensions somewhat in order to make it conform better with the material he may have in hand.

Tools. Saws, plane, hammer, brace, ½″ bit, spokeshave, knife, try-square and rule.

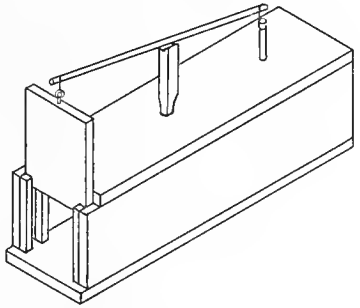
Directions. Cut the pieces to dimensions given in drawing from the 6″ board. On the 20¼″ piece lay off and bore in the center of the board the two ½″ holes 4¼″ and 12¼″ from the end. With the spokeshave or knife cut down piece A, the support for door and trigger, so that it will fit the ½″ hole. Also saw down ⅜″ V-shape notch shown in the front view of the drawing. A forked stick may be used

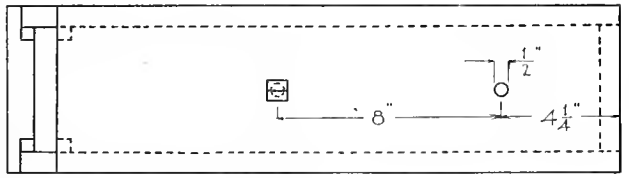
SAW BUCK

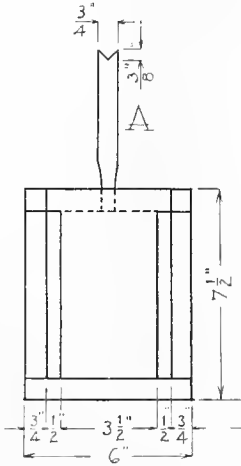


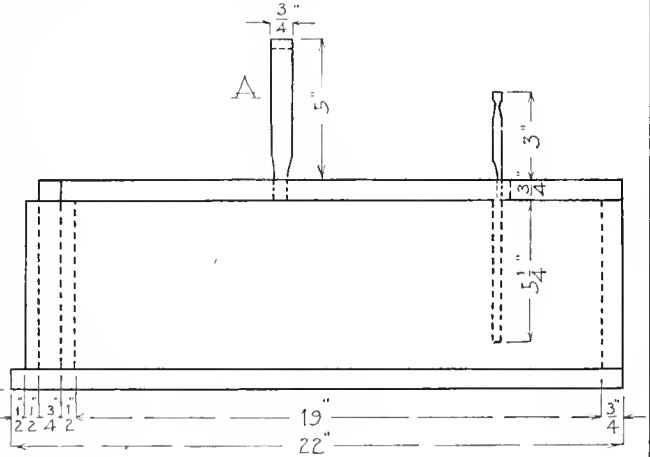


RABBIT TRAP









instead of A. Cut a notch in the upper end of the trigger to hold the string. Also where the trigger passes thru the ½″ hole, cut a notch straight into the stick, then slanting upward allowing plenty of room for play of the trigger. This notch resembles the notch in a boy's willow whistle, except that the longer cut is much elongated.

Assembly. Nail on small cleats to side boards to form slide for door. Nail on bottom piece, then the end piece. Place and nail on top, being careful that the holes are toward the back. Fit door so that it slides into place easily. Put the screw eye in the middle of the top edge of door. Put in upright piece that supports the dowel attached to door and trigger. With stout cord tie trigger and door to dowel. Adjust so that when the trap is set the door is raised to proper height.

PORCH SWING.

Purpose. The luxury of a well proportioned and roomy porch swing need scarcely be spoken of. This swing is long enough to accommodate four people. It is also wide, making it useful for a lounging place. An excellent pad for the seat may be made by folding an old comfort to the desired size and covering it with burlap, tufting at intervals to prevent bunching of the comfort.

Material.

One piece 1¾″x3½″x14′ oak or yellow pine.
One piece 1¾″x1¾″x6′2″.
One piece ⅞″x8″x12′.
One piece ⅞″x10″x8′.
One piece ⅞″x5″x17½″.
Eight ⅜″x4″ bolts.
A number of screws or finishing nails.

Bill of Stock. By studying the drawing carefully the pupil can make out his own bill of stock.

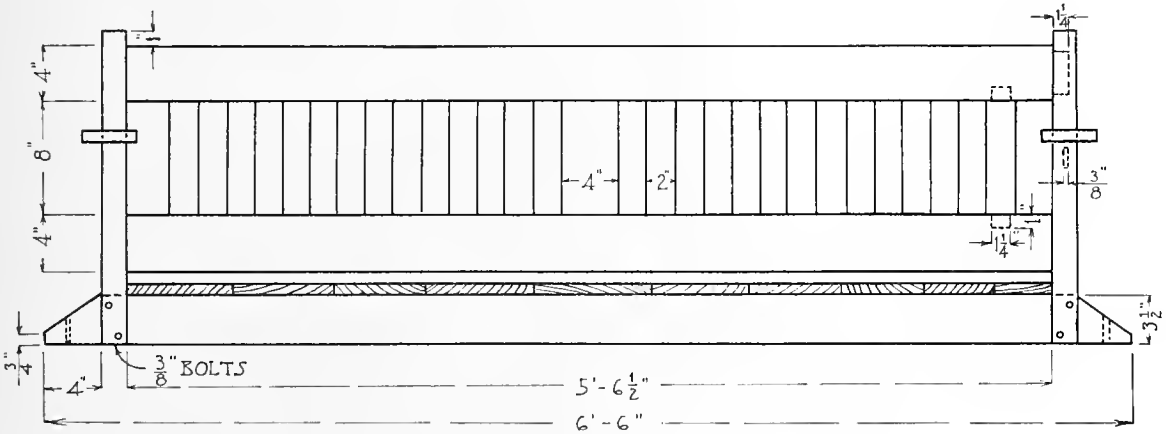
Tools. Saws, planes, hammer, rule, square, try-square, gage, pencil, brace, ⅜″ bit, chisel, screw-driver, T-bevel and wrench.

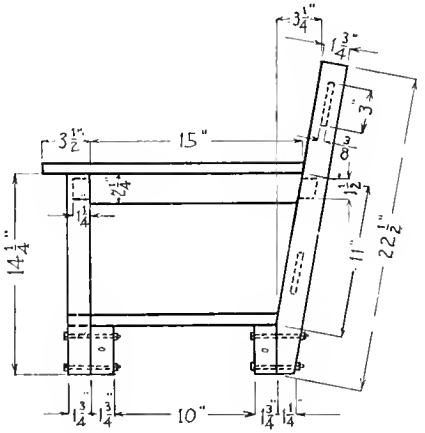
Directions. Work the piece 1¾″ x 3½″ x 14′ into the two long bottom pieces; bore the holes, and bevel the ends. Saw the 1¾″ x 1¾″ piece into the four legs. The longer pieces are to be beveled off at the lower ends. Mark two sides that are especially good and use these for the joint sides, or the sides in which you put the mortises. Lay off and make mortises from measurements given in drawing. Make the mortises in each of the front legs. Make all mortises and tenons for the back pieces. Lay out these pieces with the same operation to avoid setting of the tools so often. Saw and plane edges of pieces for bottom. Model the arms in the manner shown in the detail.

Assembly. Fit all pieces together before gluing to avoid errors. Glue the back support pieces together. Fit the ends together and glue. Glue the ends to the back support. (The above processes may be done at the same time if enough clamps are available, but it is not advisable.) Holes have already been bored in the lower supports. Place these pieces in position and with a punch, or pencil, mark the places for holes in the legs. Bore these holes and put in the bolts. Nail on the boards for the seat with finishing nails, setting the heads a little below the surface. The arms should be put on either with screws or dowels.

PORCH SWING

DETAIL OF ARM





DOG HOUSE.

Purpose. An attractive well-built dog house adds much to the appearance of the premises, and to the comfort of the animals. To the boy who likes dogs, this problem will appeal strongly. The large amount of house construction in the problem will make it a very profitable one to the student.

Material. Yellow pine framing, redwood shingles and siding.

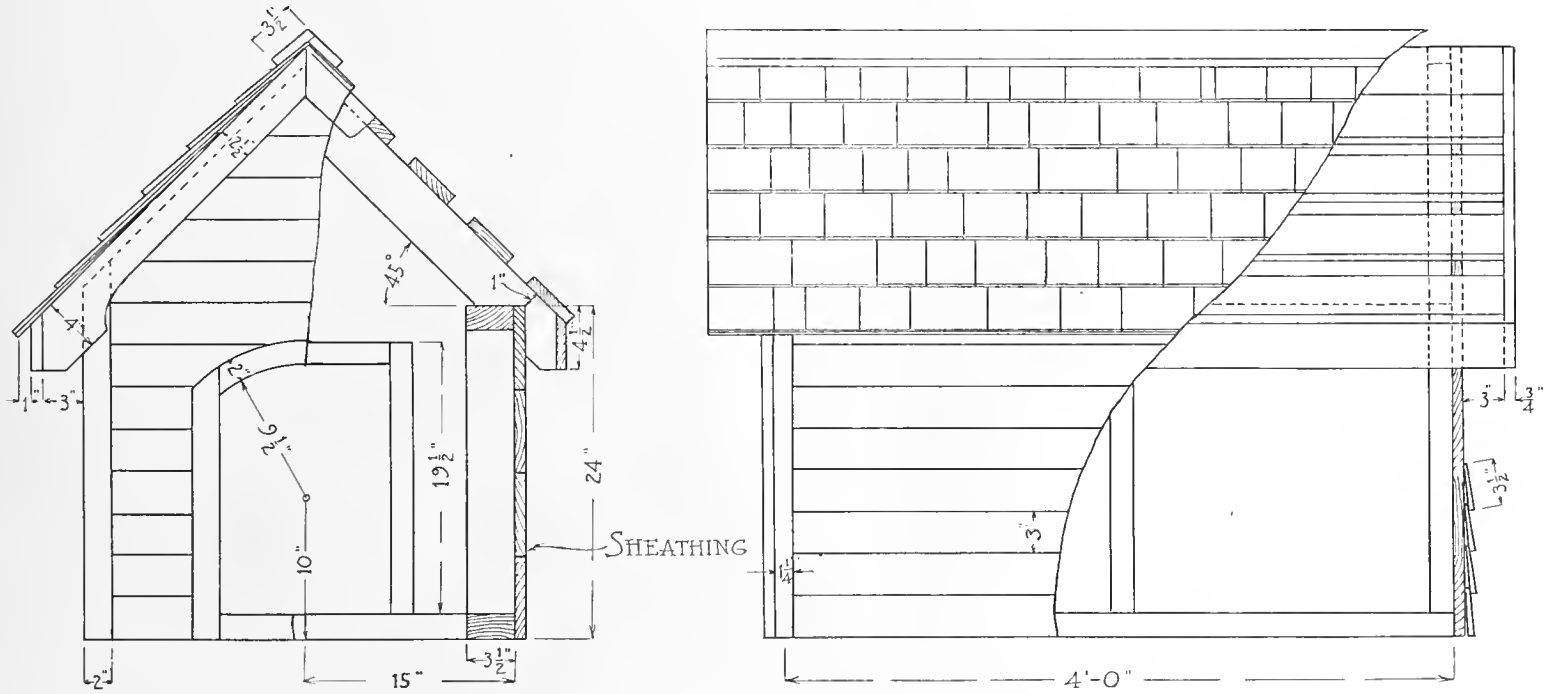
Two pieces 2″x4″x16′ studding.
One piece 2″x4″x18′ studding.
Three pieces ¾″x6″x16′ sheathing No. 3 com.
Four pieces ¾″x6″x14′ sheathing No. 3 com.
One piece ¾″x4″x5′.
One piece ¾″x8″x12′ No. 1 finishing.
One piece ¾″x8″x10′ No. 1 finishing.
Seven pieces 3½″ siding 16′ long.
One-half bunch shingles.
An assortment of nails.

Bill of Stock. This project differs considerably from the ones preceding in that it is not usual to cut all pieces before beginning work, but to cut and assemble at the same time. With the drawing before the pupil it will be an easy matter to make out the sizes of pieces as the building proceeds.

Tools. Saws, planes, rule, square, try-square, gage, coping saw and hammer.

Directions and Assembly. First make the frame which is made of studding. Saw the studding to dimensions and nail together with 16d. common nails. Toe-nail the cross pieces between the studding at the bottom. At one end nail in the frame for the opening. Saw and nail the sheathing on the sides. Lay out and saw the rafters. The roof angle is 45°, or a so called half pitch. This means that even numbers will be taken when using the square. You will notice on the drawing that 1″ is left where the rafter fits over the plate or corner of the frame. With a pencil-gage, draw a line 1″ from the edge the entire length of the rafter. Use this line now in laying out the rafter. Using this line as a basis and 15¾″ on each arm of the square, draw lines, thus getting the upper cut and the one that rests on the plate. At the point where this line crosses the 1″ line drop a second line at right angles to it. Measure out 3″ and draw a line parallel to the last line drawn. Cut off the lower end of the rafter as shown in the drawing. Saw out this rafter carefully and use it as a pattern in laying out the remainder of the rafters. When all rafters are cut nail them on, one pair flush with each end of the frame and one pair in the middle. Saw out and nail the sheathing on the ends. Saw and nail on the roof boards. Make the corner casings to dimensions, and nail at each corner; likewise the casings for the opening. The two outer door casings are curved at the top to conform to the radii shown in the drawing. Saw, fit and nail on the siding, 3½″ siding being used. Lap ½″ at each joint. Lay out, saw, and nail on the gable casings. (Note the design shown in the end view of the drawing.) The casing is nailed to the ends of the roof boards. Saw out the casings for the eaves and bevel one edge on each piece so that it will fit up under lower roof board. Put on the shingles allowing 4½″ to the weather. Lastly nail on the saddle boards. Put on two good coats of paint to match the farm buildings.

DOG HOUSE



BREAD CUTTING BOARD.

Purpose. This cutting board is a very good problem for beginners, and it is an article that will prove very useful after it is made.

Material.
One piece 7/8″x8¼″x16¼″ pine.

Bill of Stock. Finished dimensions.
One piece ¾″x8″x16″.

Tools. Plane, chisel, try-square, rule, pencil and compass.

Directions. Plane a face side and joint edge. Lay off and plane the piece to 8″ wide. Set the gage to ¾″, and gage for thickness. Plane to middle of gage lines. Measure off the piece to 16″ in length, but do not finish the ends. Set the compass to a 4″ radius. Draw a center line lengthwise. Measure back 4″ from each end on the center line, and using these points as centers, describe semi-circles. Saw off corners fairly close to lines. Chisel carefully to lines, and sandpaper.

SWING BOARD.

Purpose. This board is constructed so that it is reasonably safe and will not slip out of the swing, or slide between the ropes. It is an excellent problem for beginners.

Bill of Stock. Finished dimensions.
One piece 7/8″x5″x22″.

Tools. Saw, plane, try-square, rule, pencil, brace, ⅝″ bit, and gage.

Directions. Lay out the holes and notches at the ends. Bore the holes from each side so as to make a smooth surface on both sides. Saw out the triangular pieces using a rip saw. Saw on the lines with care as the surface is to be left just as sawed. Notice that the V-shaped opening is formed so that the rope slips thru a space narrower than the diameter of the hole.

BENCH.

Purpose. This bench, altho a homely appearing article, will be a joy to the mother of the boy who makes it. It is light and easily moved, and can be used for so many purposes. Two tubs sit easily on the bench on wash day. Placed out doors in the shade, it makes a fine bench for use in preparing vegetables, and many things for the table. It also furnishes a fine wash bench for the men on the farm who like so to splash water, and it will be found most useful about the barn.

Material.
One piece ¾″x14″x4′ pine.
One piece ¾″x10″x3′10″.
One piece ¾″x12″x3′.
Twenty 1½″ No. 9 flat heat screws.

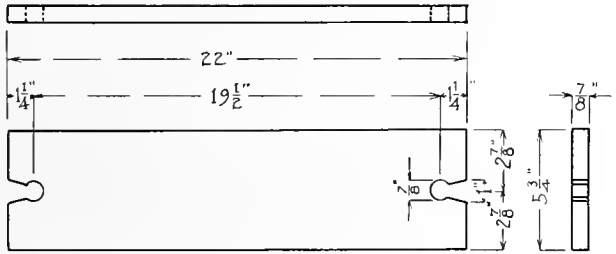
Bill of Stock. To be made out by the pupil.

Tools. Saws, plane, square, rule, pencil, brace, ¾″ bit, screw-driver, 7/32″ drill, and counter sink.

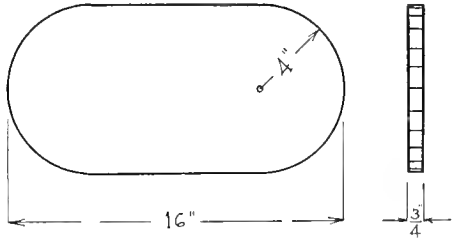
Directions. Saw and plane all pieces to dimensions shown in the drawing. Draw a center line thru each leg. Measure off from one end 8″. Measure out 4″ from the same line and draw the triangle. At the apex of this triangle bore a ¾″ hole. Rip-saw carefully on the lines of the triangle, as the surfaces are to be left just as sawed. From opposite end of the leg lay off on each edge a line 5″ from end. Set gage to ¾″ and gage to this line. Saw out notch carefully. Notice that the braces are to be beveled two inches. On the lower edge lay off 2″, connect this point with the opposite corner, draw line and saw off. Lay off and bore holes for screws.

Assembly. Screw side braces to legs. Put on the top.

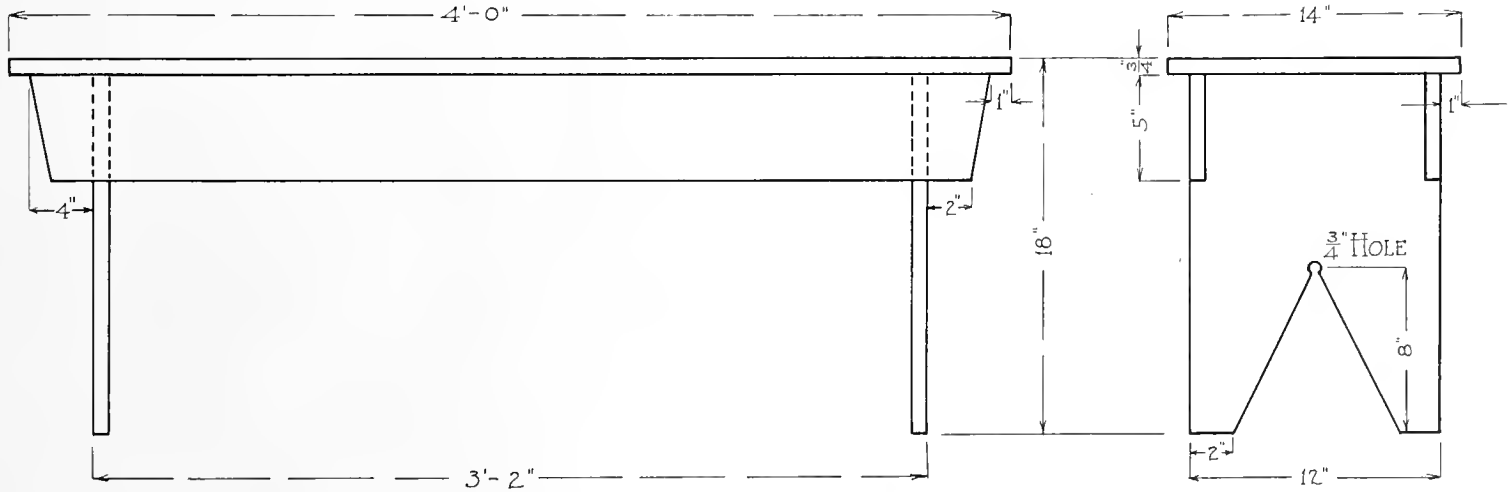
SWING BOARD



BREAD CUTTING BOARD



BENCH



FLY TRAP.

Purpose. This fly trap, properly baited, will catch quarts of flies in a season. Set a dish of sweetened food under the trap, and keep it moist. The flies attracted to the food fly up thru the dark tin covered part below, and pass thru the small hole toward light above. The door at the top permits the trap being emptied at any time, after the flies are first smoked well. A trap like this is especially good for porches where flies gather when attracted by cooking. They are also excellent in grocery stores or in any place frequented by flies.

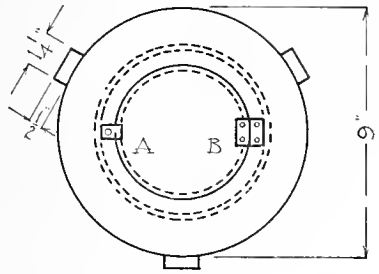
Material. Pine.

(1) One piece ¾″x10″x20″.
(2) One piece ¾″x6″x21″.
(3) One piece tin 6¾″x2′4½″.
(4) One piece screen 18″x3′.
(5) One small butt hinge with screws.
(6) A number of small tacks, also 6d. common nails.

Tools. Rip and crosscut-saw, keyhole saw, coping saw, plane, wood file, gage, rule, pencil, try-square, screw-driver, and hammer.

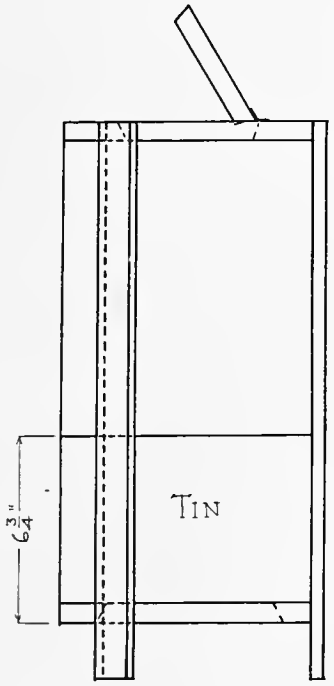
Directions. On piece No. 1 in list of materials lay off two circles with diameters of 9″. Saw these to the line with the coping saw. On one piece for the top lay off another circle, with the same center, with a 4¾″ diameter. This piece must be sawed with an inward slant of ¼″ as shown in the drawing. This prevents the lid from slipping thru. With a small drill bore a few holes so that the key hole saw may be started. Finish with key hole or coping saw. On the other piece lay off and saw a circle with a diameter of 6″, the bevel slanting outward. This piece is taken entirely out to give place for the screen cone. Work out the legs.

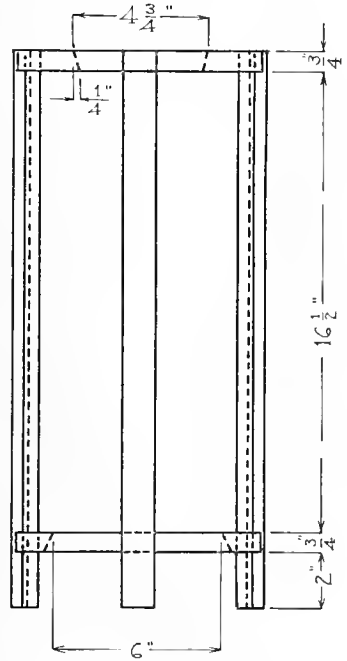
Assembly. Shape a cone out of the screen leaving a ¼″ hole at the top. With stout cord sew the screen together; then tack it in at the bottom. Make it all perfectly tight so that no flies can by any means escape. Carefully tack the screen to both the top and bottom, leaving the lap to come beneath one of the legs. Tack on the tin making the lap come beneath another leg. Nail on the three legs. Put the hinge over the place where the holes were bored to begin the sawing so that the hinge will cover any open space. Opposite the hinge put on a small wooden button. The tin around the bottom of the trap makes the lower part dark so that the flies work up towards the light and pass the hole in the top of the cone. Darkening the lower part with paper has the same effect, but the paper does not last.

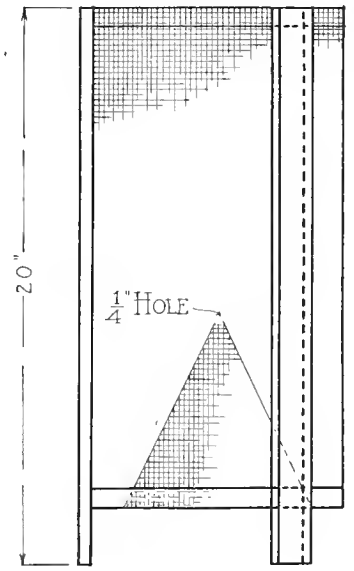


FLY TRAP

A - WOODEN BUTTON
B - HINGE







IRONING BOARDS.

Purpose. An ironing board is a difficult problem, since it must be as light and as easily handled as it is possible to make it, and yet possess stability. Board No. 1 is an excellent one in that it is light and easily handled and yet it is especially stable. The absence of much frame work underneath makes it especially fine for ironing skirts and dresses, and it also allows a basket to stand underneath the large pieces that are being ironed. The board is fastened to a table when in use, the wide end of the board slipping under the edge of the table. The long leg of the brace then slips up thru the seven inch cut-out place on the wide end of the board. The notch on this brace catches hold of the edge of the table, and the weight of the board automatically gives it support. When not in use this board folds into a very small space.

Board No. 2 is less stable than the first one, is heavier and not so easily handled, yet it has an advantage in that it can be set into any desired place while in use.

No. 1.

Material. Pine, basswood, or yellow poplar.

One piece ⅞″x15″x4′5″.
One piece ⅞″x10″x3′9″.
One piece ⅞″x12″x17½″.
Two pairs 1½″ butt hinges.

Bill of Stock. The bill of stock is easily made out from the drawing.

Tools. Saws, plane, rule, pencil, chisel, try-square, square, brace, small drill, coping saw, compass and screw-driver.

Directions. Lay off and saw all pieces to dimensions given in the drawing. On the large piece for the ironing surface measure in $3\frac{3}{4}''$ from the end and square across. Set gage to 4″, and gage lines along each edge from the end of the line just drawn. Saw to the gage lines with the rip-saw and on the cross line with the coping saw. At the opposite end measure in from each edge $2\frac{1}{2}''$, measure back 15″ from the end, and connect these points. Saw and plane to the line just made, and slightly round the corners. Measure in 10″ from one end of the long brace and with the compass set at $1\frac{1}{4}''$, and using this point as a center, describe an arc. Extend this line from this point to the end of the board with a gage. Repeat on opposite side of the board, and saw to the line. At the opposite end of the board, measure in $\frac{5}{8}''$ and $2\frac{5}{8}''$, and draw lines across, using the square. Saw down $\frac{1}{4}''$ on the first line, and beginning back at the $2\frac{5}{8}''$ line, chisel in a slanting line to the bottom of the saw kerf just made. This makes the notch which catches onto the table edge.

Assembly. Put on the cross braces with screws at the positions shown in the drawing. Screw on the 7″ cross piece on the long brace. Hinge on the connecting brace to the long brace. The other end of connecting brace is hinged to the under cross strip of the ironing board.

No. 2.

Material. Same as in previous problem.

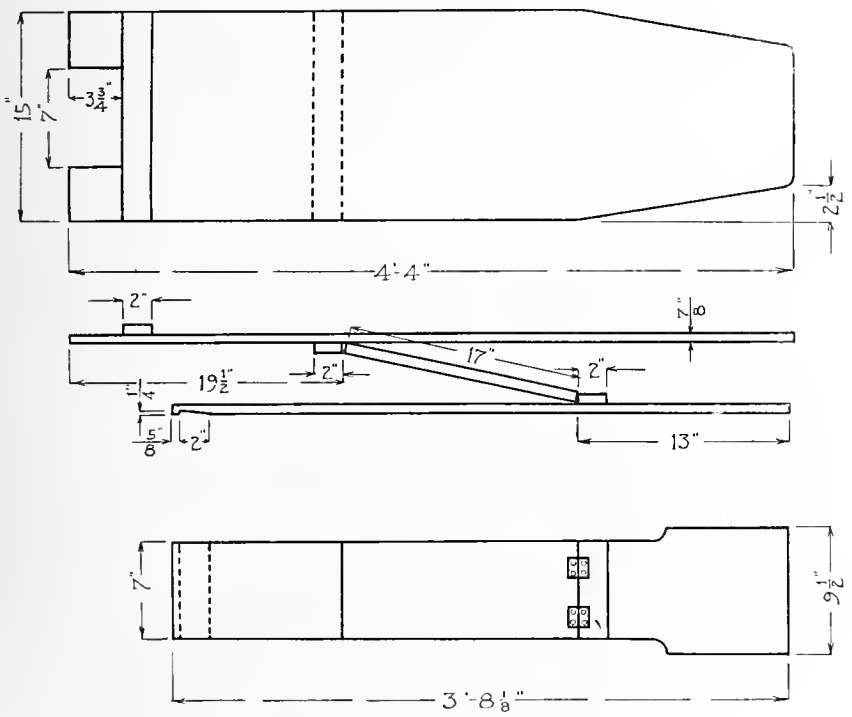
One piece ⅞″x14″x10′.
One piece ½″x1½″x3′4″.
One piece 1¾″x1¾″x4″.
Several 1½″ screws and small brads.

Bill of Stock. Finished dimensions.

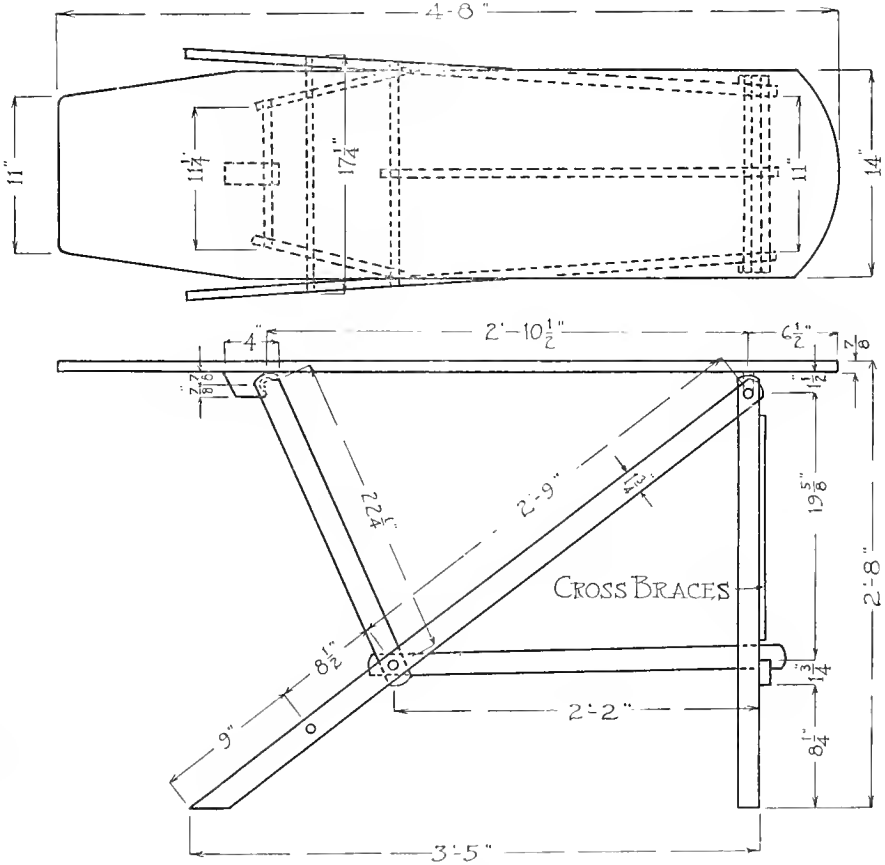
One piece ⅞″x15″x4′8″.
Two pieces ⅞″x1¾″x4′3″.
Two pieces ⅞″x1¾″x2′7″.
Two pieces ⅞″x1¾″x2′½″.
One piece ⅞″x1¾″x2′6″.
Two pieces ⅞″x1¾″x14″.
Two pieces ½″x1½″x20″.
One piece 1¾″x1¾″x4″.
One piece ¾″ diameter x 17¼″.
One piece ¾″ diameter x 11¼″.
One piece ¾″ diameter x 16″.

IRONING BOARDS

No.1



No.2



Tools. Saws, plane, rule, pencil, gage, wood file, brace, $\frac{3}{4}$″ bit, chisel, try-square, screw-driver and hammer.

Directions. You will notice that all material except the top is $1\frac{3}{4}$″ and that instead of measuring from the ends of pieces the centers of holes are used. Rip-saw and plane all pieces to dimensions in bill of stock. Lay off and bore holes to dimensions indicated, shaping the ends as shown in the drawing. The top may be modelled to suit worker, the drawing being a suggestion. Plane down the rounds, or better still, turn them out on a lathe. Care must be taken to make all joints fit snugly to keep the board from wobbling when in use.

SCREENS.

Purpose. While these two screens may be used for their original purpose of screening doors and windows, it is also entirely possible to vary the proportions of the screens so that they may be used in outdoor sleeping porches and all kinds of screened porches and rooms.

Door Screens.

Material.

(1) Two pieces 1⅛″x3″x6′10″ pine.
(2) One piece 1⅛″x6″x2′5½″.
(3) One piece 1⅛″x4¼″x2′5½″.
(4) One piece 1⅛″x3″x2′5½″.
(5) One piece 1⅛″x2″x1′11½″.
The above pieces may all be made from a board 1⅛″x12″x8′.
(6) One piece galvanized screen 6′3″ cut from roll 30″ wide.
(7) Two pieces of molding 14″ long.
(8) A number of 1″ finishing nails, also a number of 2 oz. tacks.
(9) Glue.

Bill of Stock. Finished dimensions.

(1) Two pieces 1⅛″x2¾″x6′8″ for sides.
(2) On piece 1⅛″x5½″x2′5½″ for bottom cross piece.
(3) One piece 1⅛″x4″x2′5½″ for middle cross piece.
(4) One piece 1⅛″x2¾″x2′5½″ for lower cross piece.
(5) One piece 1⅛″x1¾″x1′11½″ for lower brace.

Tools. Saw, plane, rule, try-square, gage, brace, $\frac{1}{2}$″ bit, $\frac{1}{2}$″ chisel, hammer, knife, and small hand made miter-box.

Directions. Rip-saw from the piece of pine two pieces $\frac{7}{8}$″ x 3″ x 6′10″. Plane one edge on each. Put both pieces in the vise, the planed edges upward, and mark out the mortises. These lengths are 2″ longer than the finished pieces. Leave the extra inch at each end until ready to fit screen to opening. Rip out pieces Nos. 2, 3, 4, mentioned in list of materials. Finish No. 3 to exact dimensions. Plane one edge of Nos. 2 and 4. Lay out and make tenons on last three pieces, Nos. 2, 3, and 4 in bill of stock. Plane piece No. 5 to correct dimensions and lay out and make tenons. Of all these pieces only Nos. 3 and 5 are finished to correct widths. The other pieces should be left over-sized and unfinished on the outer edges until the screen is finished and ready to be fitted to the particular opening for which it is made.

Assembly. Glue the parts together. As the screen will necessarily have to stand considerable weathering, put a few 1″ brads into the joints.

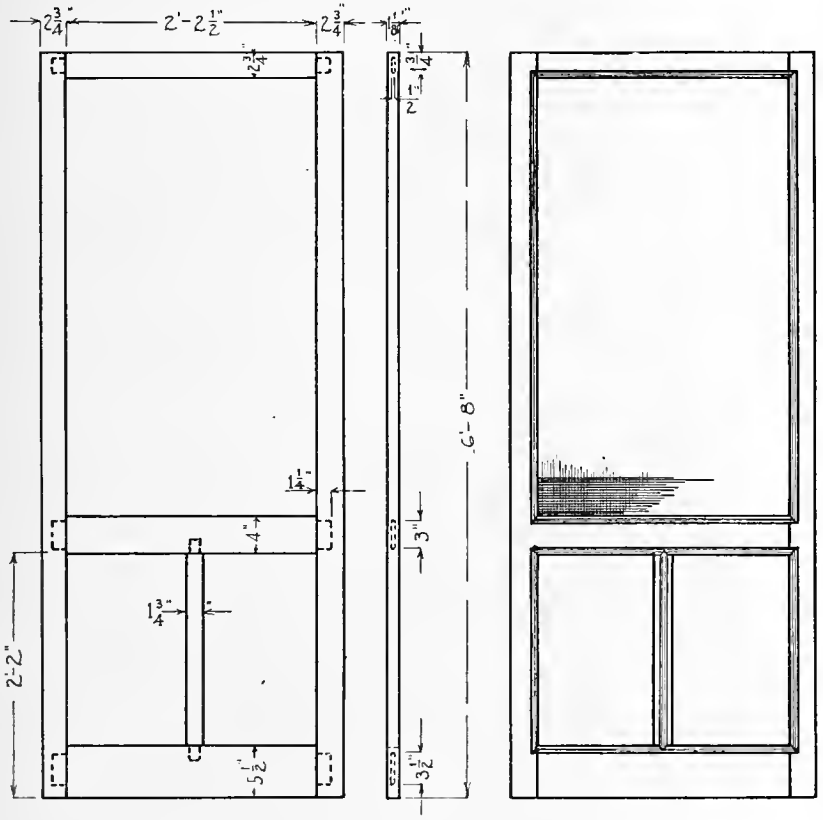
Put on the wire screening with tacks, stretching as evenly and tightly as possible. Put it on in one piece.

Miter and put on molding. Cut off extra screening with sharp knife, also screening between sections.

Fit screen to opening.

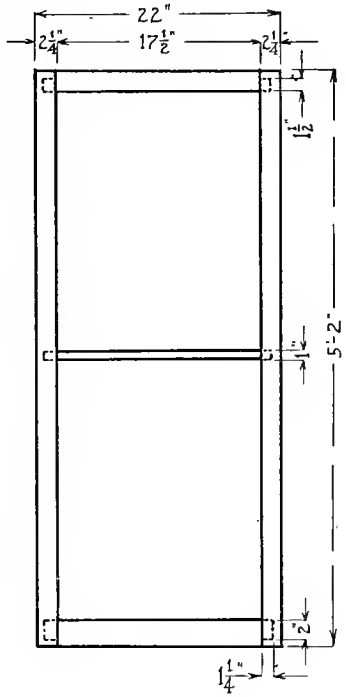
Remark: The frames and molding should be painted before the screening is put on, except the outside edges of the frame. These edges may be painted after fitting if desired.

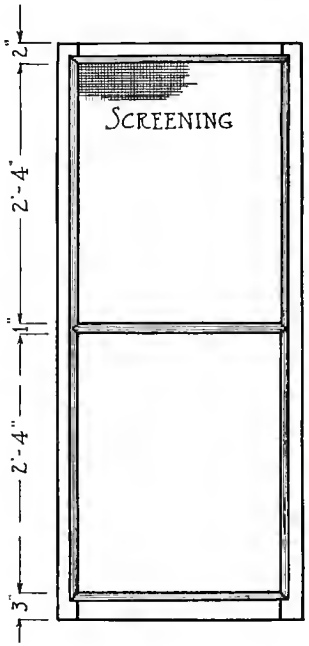
DOOR SCREEN



WINDOW SCREEN

CROSS SECTION OF MOLDING





Window Screen.

Purpose. This type of screen is coming more and more into use. It has an advantage over the old half screen in that the upper and lower sashes may be raised and lowered at will.

Material.

(1) Two pieces 7/8″x2½″x5′4″.
(2) One piece 7/8″x3¼″x20″.
(3) One piece 7/8″x2¼″x20″.
(4) One piece 7/8″x1¼″x20″.
The above pieces may be made from a board 7/8″x5″x8′8″.
(5) One piece galvanized screening 4′11″ cut from a roll 20″ wide.
(6) Two pieces of molding, one 10′ and the other 8′.
(7) A number of 7/8″ brads and 2 oz. tacks, also some glue.

Bill of Stock. The bill of stock may be made out by the pupil. Make an allowance of 2″, as in the door screen, for the side pieces.

The tools, directions and assembly are the same as in the previous problem.

KITCHEN TABLE.

Purpose. This table is an excellent one for the kitchen and it can be made as much larger as is desired. It is also suitable for a student's table. From the construction standpoint it affords an application for the earlier exercise work, since it contains good work in planing tapers, making mortise-and-tenon joints and glue joints. It also contains work in drawer construction, and the common commercial form of joint as shown in the detail.

Material. Pine.

One piece 2½″x2½″x10′.
One piece 7/8″x12″x16′.
One piece ½″x3½″x3′10″.
One piece plaster board 15½″x15½″.
One piece zinc 2′6″x3′6″.
Four lag-screws 3/8″x4½″.
A number of 1¼″ screws and 6d. casing nails.

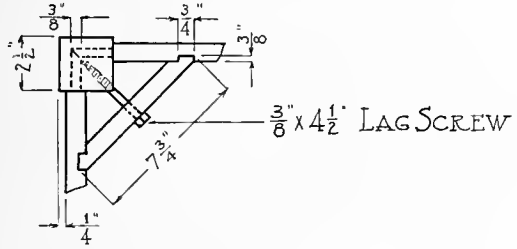
Bill of Stock. To make out a bill of stock adds greatly to the power of the student, hence the bill has been left out.

Tools. Saws, planes, rule, pencil, try-square, gage, chisel, brace, 3/8″ and 5/16″ bits, screw-driver, hammer, gouge and plow.

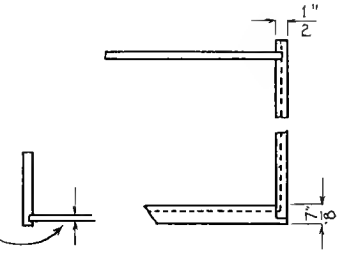
Directions. Measure down 5″ on the legs and pencil around the leg. Select two opposite sides to plane first. Measure in from each corner on the floor end and connect with the ends of the above lines to give the slant of the legs. Plane down to the lines. Two sides being planed, lay off and plane the two other sides in the same manner, the leg thus being 2½″ square at the top and down 5″, then tapering to 1½″ square at the lower end. Lay out and make the mortises 3/8″ wide and 3″ long, the mortises beginning 1″ from the top of the leg in each case. Rip-saw and plane to dimensions the sides and ends. Lay out and make the tenons at each end. Saw and chisel out a 3/4″ joint 3″ from the beginning of the tenon. This forms a groove across the width of the boards. (See detail of joint in drawing.) On one side saw out an opening 3½″ x 16″ for a drawer. Fit the joints together to see that all fit tightly. While the table is still in this position make the corner braces and put them in place to be sure that they fit. Saw out and join the pieces for the top. Make the runners and also the drawer as shown in the detail. Plow out a 1/4″ x 1/4″ groove on the front and side pieces 1/4″ from the lower edge and fit in a piece of plaster or compo board for the bottom. Fit a ½″ piece and nail it in at the rear end. This forms a drawer that has no wide cracks in the bottom, and being nailed, it cannot slide out. Make a small 4″ handle with a plane and gouge.

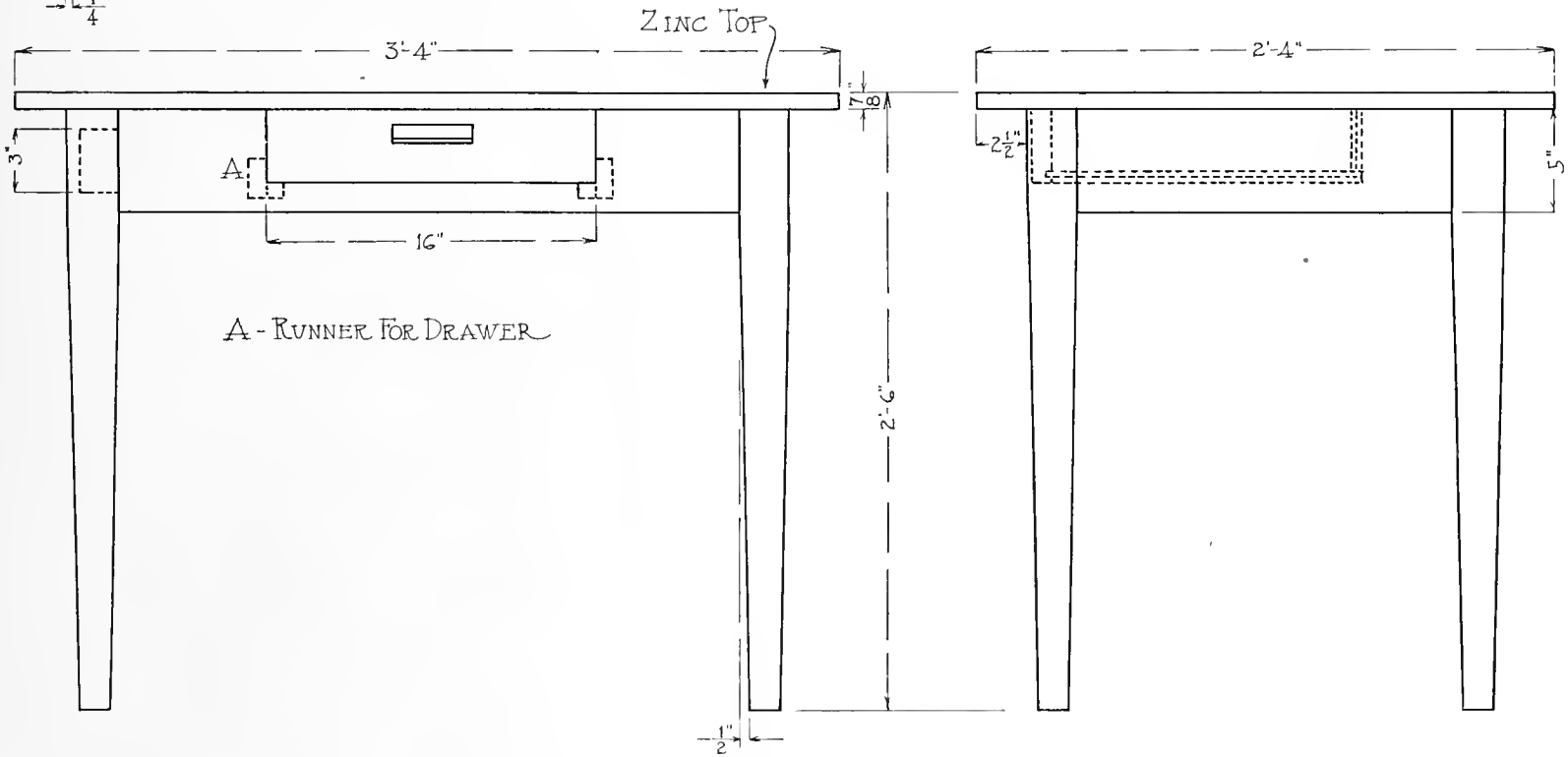
KITCHEN TABLE

DETAIL OF JOINT



DETAILS OF DRAWER





A - RUNNER FOR DRAWER

Assembly. Glue the legs, sides, braces, and ends together, doing this all at one glueing. When the glue has set bore a $\frac{3}{8}''$ hole thru the corner brace, and in the same direction bore a $\frac{5}{16}''$ hole in the leg, and screw in place the $\frac{3}{8}''$ x $4\frac{1}{2}''$ lag-screw. Put the drawer runners together with screws and either nail in place with finishing nails or with screws from the under inside in a slanting direction. Nail together the drawer, and put on the handle with two screws from the inside. Glue together and nail the top. Fit the zinc to the top, fitting the corners carefully and tack it on.

KITCHEN SINK.

Purpose. This sink has been designed for the farm home where there is no water system. The top part is made water tight but without a drain. Water may be spilled into the sink while using but it must be wiped out. The lower part is arranged for the bulky kitchen utensils. One shelf is provided, while the floor is used for the lower shelf.

Material. White pine and fir ceiling.

Nine pieces $\frac{5}{8}''$x4″x10′ fir ceiling.
Two pieces $\frac{5}{8}''$x4″x12′ fir ceiling.
One piece $\frac{7}{8}''$x12″x12′.
One piece molding 10′ long.
Two pairs $1\frac{1}{2}''$ butt hinges.
Two cupboard catches.
An assortment of nails and some white lead.

Bill of Stock. Finished dimensions.

(1) Four pieces $\frac{7}{8}''$x2″x3′2$\frac{1}{8}''$ for lengthwise part of frame.
(2) Four pieces $\frac{7}{8}''$x2″x15$\frac{3}{8}''$ for ends of frame.
(3) Two pieces $\frac{7}{8}''$x2″x13$\frac{5}{8}''$ for cross pieces of frame.
(4) Two pieces $\frac{7}{8}''$x6″x3′5″ for lengthwise part of sink.
(5) Two pieces $\frac{7}{8}''$x6″x15$\frac{1}{2}''$ for end of sink.
(6) On piece $\frac{7}{8}''$x15$\frac{1}{2}''$x3′4″ for floor of sink.
(7) Twenty-seven pieces $\frac{5}{8}''$x4″x2′2″ fir ceiling.
(8) Ten pieces $\frac{5}{8}''$x4″x22″ fir ceiling for doors.
(9) One piece $\frac{7}{8}''$x15$\frac{3}{8}''$x3′3$\frac{7}{8}''$ for shelf.
(10) Two pieces $\frac{7}{8}''$x2″x2′5″ for casing over and under doors.
(11) One piece $\frac{7}{8}''$x2″x22″ for casing between doors.
(12) Four pieces $\frac{7}{8}''$x2″x13″ for nail ties for doors.

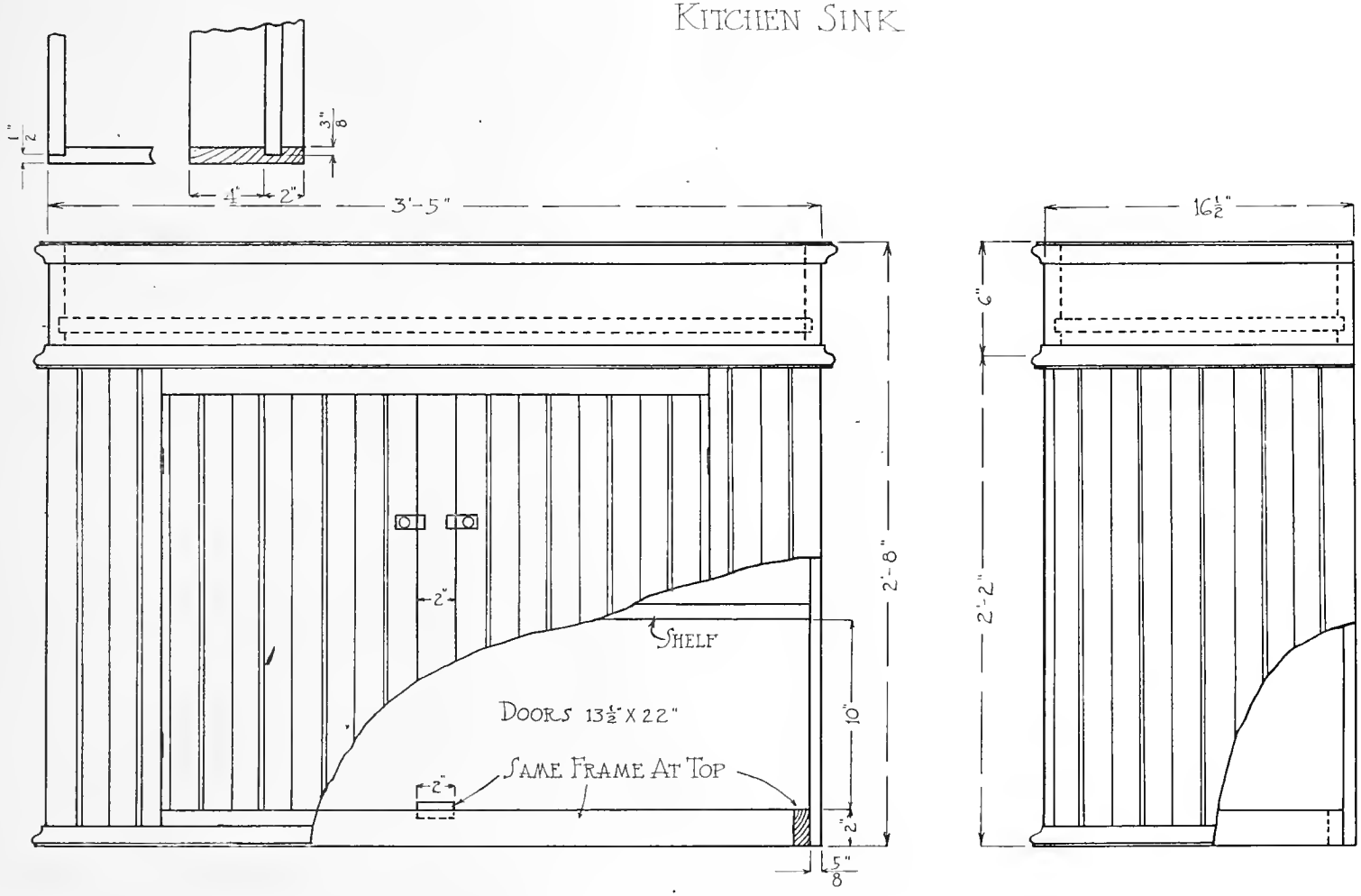
Tools. Saws, plane, plow, rule, pencil, square, try-square, screw-driver, small miter-box, chisel, gage, and hammer.

Directions and Assembly. The sink is made in two parts. The upper or water tight part, and the lower cabinet part. In making the upper part plow a groove $\frac{3}{4}''$ wide and $\frac{3}{8}''$ deep in each of the two sides and end pieces $1\frac{1}{4}''$ up from the lower edge, as shown in the detail of corner. When thru with the grooves make the joints as shown in the detail of the corner. Fit together to see that all joints are tight. Before nailing together put white lead in all the joints.

Saw and plane the frame pieces Nos. 1, 2, and 3 in bill of stock to exact dimensions. Nail together both sections. Cut the fir ceiling to lengths given in No. 7 in bill of stock. Nail on the back ceiling first, the pieces coming flush with the end as shown in the drawing. Likewise nail on the end pieces. Nail in the shelf. Nail on the two outside pieces of ceiling on each side; then the upper and lower casings in front, and the casing between the doors. Make the doors separately, fit to the opening, and then put on the hinges and cupboard catches. Lastly lay off the molding to lengths, miter the corners carefully, and nail on with finishing nails, setting the nails slightly beneath the surface.

DETAIL OF CORNER

KITCHEN SINK



KITCHEN CABINET.

Purpose. There are many kinds of kitchen cabinets, and the one given here is meant only as a guide. Each farm kitchen has its own suitable place for the cabinet, and the proportion and size should fit the place intended for it. Often an unused door opening can be utilized, affording a cabinet which opens between kitchen and dining room or kitchen and pantry. The number and size of the shelves too may be varied to suit the individual needs of the housewife.

Material.

Seventeen pieces 4″ ceiling 14′ long.
One piece 1½″ molding 9′ long.
Two pieces ¾″x12″x14′.
Five pieces ¾″x12″x10′.
One piece ¾″x10″x14′.
One piece ¾″x10″x10′.
Four cupboard catches.
Four pairs of butt hinges, also a number of 6d. and 8d. finishing nails.

Bill of Stock. Finished dimensions.

(1) Two pieces ¾″x24″x6′7¾″ for sides.
(2) Two pieces ¾″x10″x3′11¼″ for upper outside casing.
(3) Two pieces ¾″x10″x2′6″ for lower outside casing.
(4) One piece ¾″x2½″x3′4″ for lower casing.
(5) One piece ¾″x1½″x3′4″.
(6) One piece ¾″x2½″x5′.
(7) One piece ¾″x2″x3′11¼″.
(8) One piece ¾″x2″x2′6″.
(9) One piece ¾″x7″x5′ for front projection.
(10) Two pieces ¾″x22¾″x4′10½″ for lower shelves.
(11) Four pieces ¾″x16¾″x4′10½″ for upper shelves.
(12) One piece ¾″x18″x5′ for top.
(13) Eight pieces ¾″x3″x19″ for braces for doors.

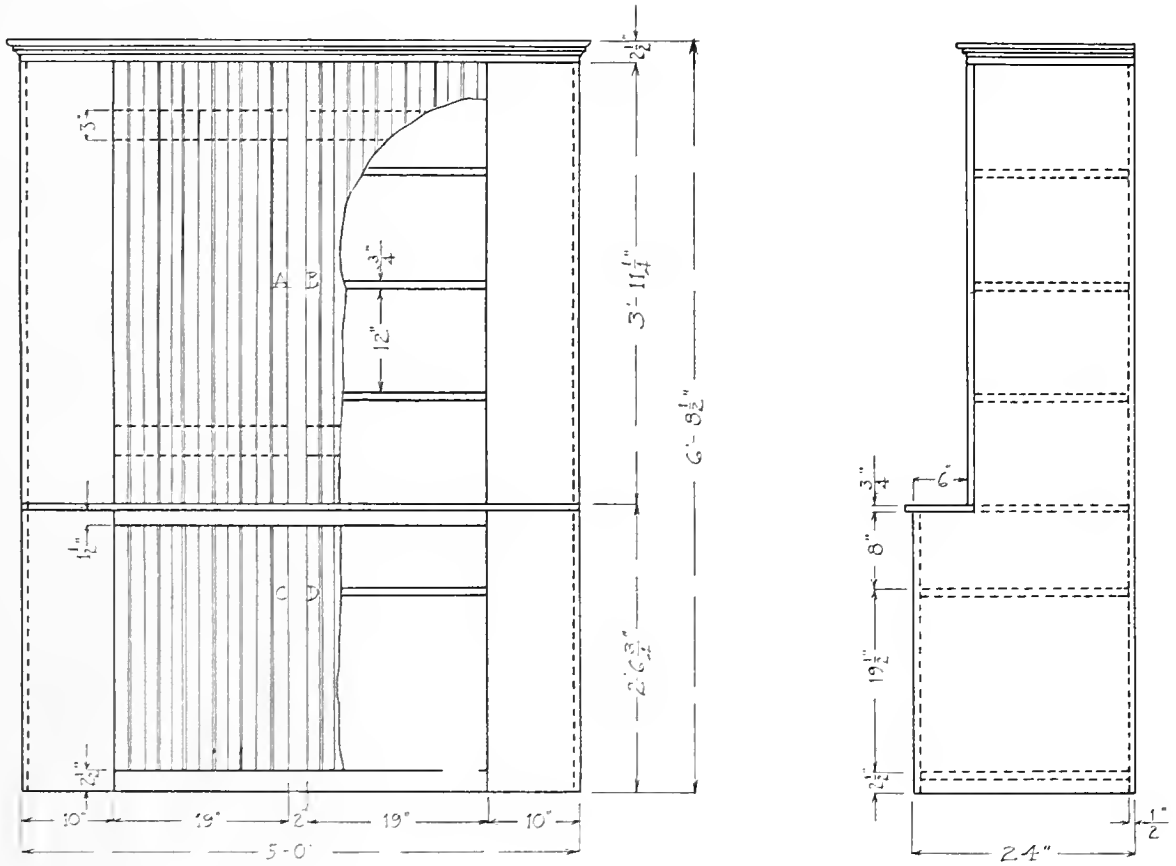
Tools. Saws, plane, square, try-square, rule, pencil, gage, screw-driver, gimlet bit, hammer and miter-box.

Directions. Glue 12″ boards together to make two ends, mentioned in No. 1 in bill of stock. Saw out the piece 6¾″ x 4′1¾″ from each and use this scrap in making smaller parts such as Nos. 4, 5, 7 and 8. Work out all other pieces to dimensions given. The shelving need not be glued unless so desired. Make the four doors slightly longer than the dimensions needed, and fit them to the openings when ready to hang.

Assembly. Lay the two ends on the floor with the back edge down and nail on the top piece, then the shelves, the lower one first. It is best to rest the shelves on a small ½″ x ¾″ cleat, but it is possible to nail them thru the outside, setting the nails carefully so that the appearance is good. Nail on the ceiling at the back. You are now ready to begin casing the front. Put in the two lower upright 10″ casing, then the lower cross casing and lastly the upright middle casing. Above the projection put on the casing under the molding, then the outer 10″ casing and lastly the middle upright casing. Miter the joints of the molding at the front corners, and nail it all on. Fit doors to openings. Put on the hinges, being careful that the screws go through into the under braces. Lastly put on the cupboard catches.

KITCHEN CABINET

CUPBOARD CATCHES AT A·B·C·D



ARTICLES FOR THE GARDEN.

Purpose. The articles here given are needed in almost every garden. The five problems shown will furnish a good beginners course, especially in a rural school.

The row marker and shrub label are small beginning problems.

This tomato trellis is the best of many frames for raising tomatoes. The construction will possibly take a little more time the first year, but it is a great time saver, considering the number of years one of these may be used.

The transplanter is used is setting out cabbages, tomatoes, and any other plants or flowers.

The trellis for a small vine is a type. The dimensions may be changed to suit the vine for which it is made.

Row Marker.

The list of materials and the bill of stock are left out in each case as a glance at the drawing will suffice.

Directions. Plane the piece to dimensions and lay it off as shown in the drawing. Saw outside the lines and plane smooth.

Shrub Label.

Directions. Lay off as shown in drawing and finish with a knife.

Tomato Trellis.

Material. Any cheap lumber such as crates, boxes, etc.

Tools. Saws, gage, rule, pencil, try-square, and hammer.

Directions. Work all pieces to dimensions given in the drawing. Make one complete side. Place the two legs for the other side in position with reference to the finished side, and nail the pieces together to form the second side. (This is done to make sure the trellis will fold.) Drive in a nail at each end and bend over the point. This nail will act as a hinge.

Transplanter.

Tools. Saw, plane, knife, gage, rule, pencil, brace, 1″ bit, wood file, draw-knife, hammer and try-square.

Directions. On the larger piece measure in $\frac{1}{2}$″ and pencil around the piece using the try-square. In the center of one side at one end bore a 1″ hole thru the piece. Beginning down 2″ cut the remainder of the piece down, with a draw-knife, first, to a four sided figure, then eight sided and lastly to a round cone-shaped figure. Round off the edges with a wood file. Saw off the ends, using the lines made at the beginning. This cuts away the top half of the bored hole, leaving the upper end to be shaped as shown in the end view of the drawing.

Make a cylinder of the 1″ x 1″ x 4″ piece. Place the cylinder in the end, and nail, setting the nails beneath the surface so as not to injure the hands.

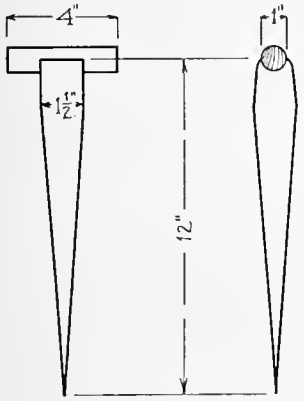
Trellis for Small Vine.

Tools. Saws, plane, gage, rule, try-square, pencil and hammer.

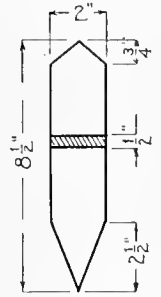
Directions. Taper the center upright, beginning about 6″ from the end. Finish the other pieces to dimensions shown in the drawing, and with 8d. common nails, nail on the cross-pieces leaving a space of 1″ at the top, and 6″ between the other pieces in the order shown in the drawing.

FOR THE GARDEN

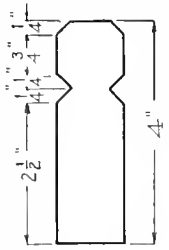
TRANSPLANTER



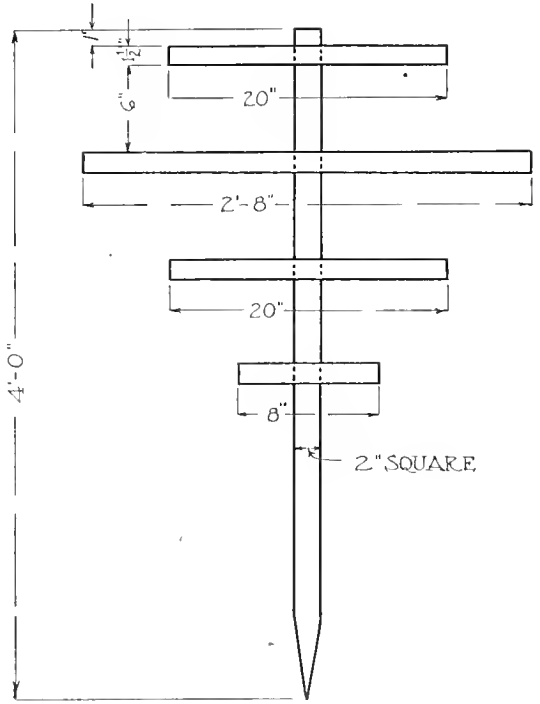
ROW MARKER



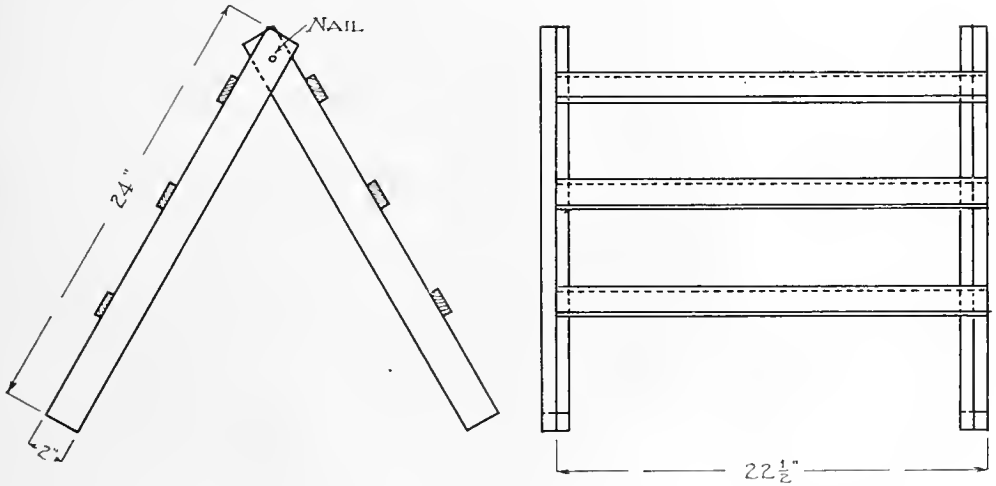
SHRUB LABEL



TRELLIS FOR SMALL VINE



TOMATO TRELLIS
TO BE FOLDED WHEN NOT IN USE



LADDERS.

Purpose. The step ladder here given is especially designed to be made in the shop. It does not require the patented iron folders nor the iron frame at the top. The iron rod may be cut and threaded in any ordinary shop.

The second ladder is made especially for picking fruit. The long sharp upper end may be slid into the fork of a limb, thus saving the limbs from being spread apart and broken. There is less chance for fruit being knocked off the tree, and much less chance for accidents.

Step Ladder.

Material. Pine.

One piece ¾″x8″x10′.
One piece ½″x8″x5′.
One ¼″x17″ rod with a nut at each end.
One ¼″ rope 3′4″ long.
A number of 6d. and 8d. common nails.

Bill of Stock. Finished dimensions.

(1) Two pieces ¾″x3½″x5′ for supports for steps.
Four steps ¾″x3½″x one each of 14¼″, 14¾″, 15¼″ and 15¾″.
(3) One piece ¾″x4½″x17″ for top.
(4) Two pieces ½″x1⅜″x4′11″ for braces to steps.
(5) Two pieces ½″x1½″x3′4½″ for cross braces.
(6) Three pieces ½″x1½″x one each of 17½″,16¾″, and 16″ for braces.

Tools. Saws, plane, chisel, rule, pencil, try-square, T-bevel, brace, ¼″ bit, gage and hammer.

Directions. Saw and plane all pieces to dimensions given in bill of stock. Set the T-bevel at an angle of 75°. Place the bevel at one end of the board used for support of steps to get the angle of the base. Measure up 11¼″ and 12″ and draw a line at the set angle to mark position for first step. Continue this to the end of the piece. Lay out the similar board in the same way, remembering that the notches cut for the steps are to be on the inside. Set the gage to ¼″ and gage along each edge between the lines just drawn to mark place for the notches. Saw down to the gage line and chisel out the wood between the lines. Bore a ¼″ hole at the top ⅞″ from the end and ⅞″ from the edge. In sawing the steps to the desired length be sure they have the proper angle. Bevel the pieces No. 4 in bill of stock at one end, and at the other end bore a ¼″ hole ¾″ from the end, and round off the corners.

Assembly. Put the steps and side pieces together with 1½″ No. 9 screws. Nail on the top. Nail the cross braces, No. 6 in bill of stock, to the braces, and also No. 4 at the distances shown in the drawing. Hold the cross braces in position, mark the angles at the ends, and saw. Nail them on over the middle crosspiece. This gives an arch effect to the brace as a whole which allows light pieces to be used and still be of sufficient strength.

Fruit Picking Ladder.

Material. Pine.

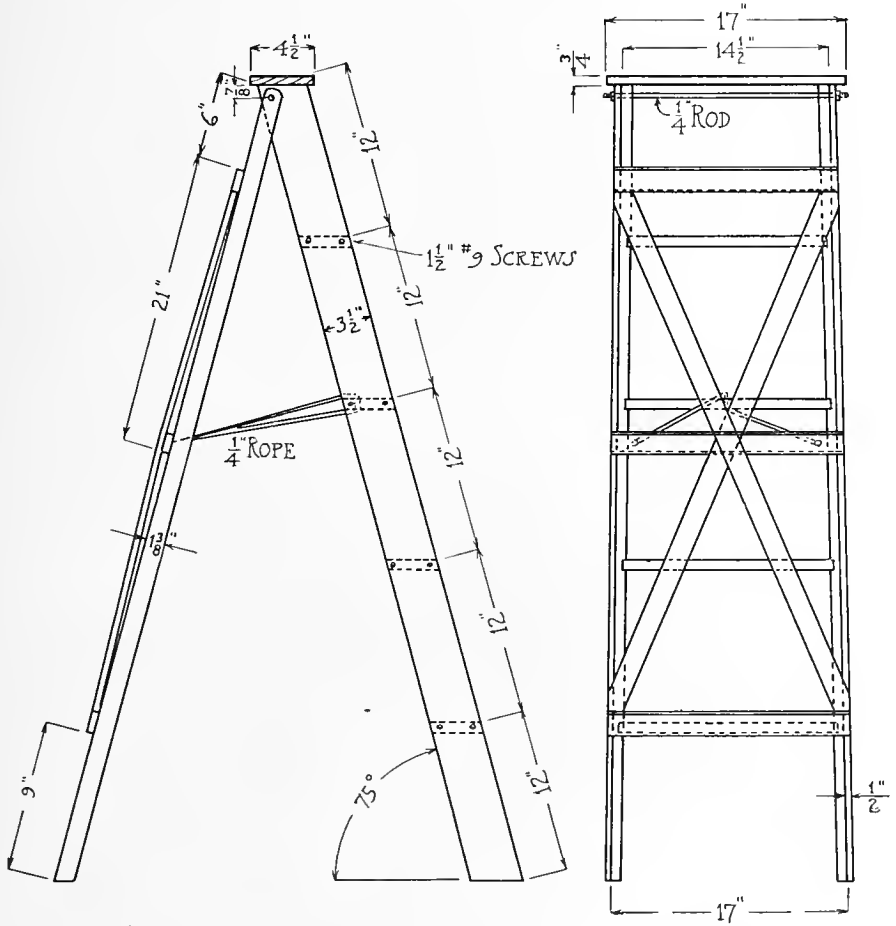
Two pieces 1½″x2½″x12′.
One piece 1½″x3½″x4′.
One piece ¾″x8″x8′ for steps.
Two bolts ⅜″x7½″.
A number of 8d. nails or 1½″ screws.

Bill of Stock. The bill of stock is almost the same as the list of material.

Tools. Saws, plane, T-bevel, gage, rule, pencil, brace, ⅜″ bit, and hammer.

Directions. Round off the upper ends of the long ladder pieces as shown in the drawing. The short upper end piece should have the width tapered from 3½″ at one end to 1½″ at the other. From each side at one end measure in 1″

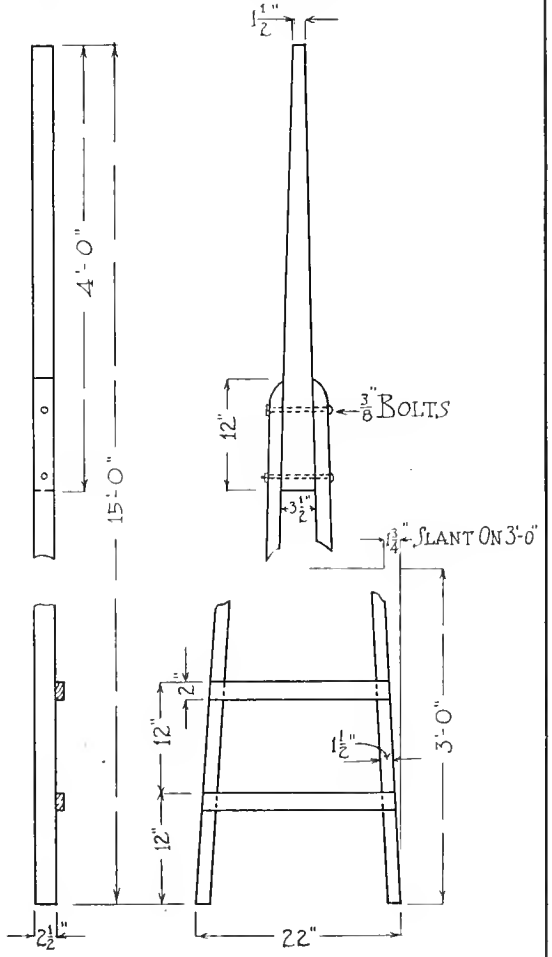
STEP LADDER



SIDE VIEW

REAR VIEW

FRUIT PICKING LADDER



and draw lines to the corresponding corner at the other end. Saw and plane down to the lines. The ladder pieces and end pieces lap one foot. Bore two $\frac{3}{8}$" holes, one about $1\frac{1}{2}$" from lower end and the other about 3" from the upper end. Mark and bore the holes in the center piece and put in the bolts.

Assembly. Put on the lower step which is 21" long. The steps are 12" apart. It is best to make the steps plenty long and then saw them off after they have been nailed or screwed on.

POTATO MARKER.

Purpose. This marker is an almost indespensable article where potatoes are raised. It marks three rows with one operation, and at the same time marks a fourth row which is used by the driver in making the next set of rows. While this marker is made primarily for potato planting, more holes may be bored in the cross pieces, allowing the runners to be set at any desired width. By using different weights, any depth of row may be made. The tongue and pin from the regular farm wagon are used.

Material. Pine with oak runners.

One piece 2"x6"x7'.
Two pieces 2"x4"x8'.
One piece 2"x4"x4'4".
One piece 3"x10"x21".
One piece $\frac{7}{8}$"x3$\frac{1}{2}$"x5'9".
One dozen lag-screws $\frac{3}{8}$"x4$\frac{1}{2}$".
One 3" ring made from $\frac{1}{2}$" stock.
Thirty inches $\frac{1}{2}$" round Norway iron.
A number of 10d. and 20d. common nails.

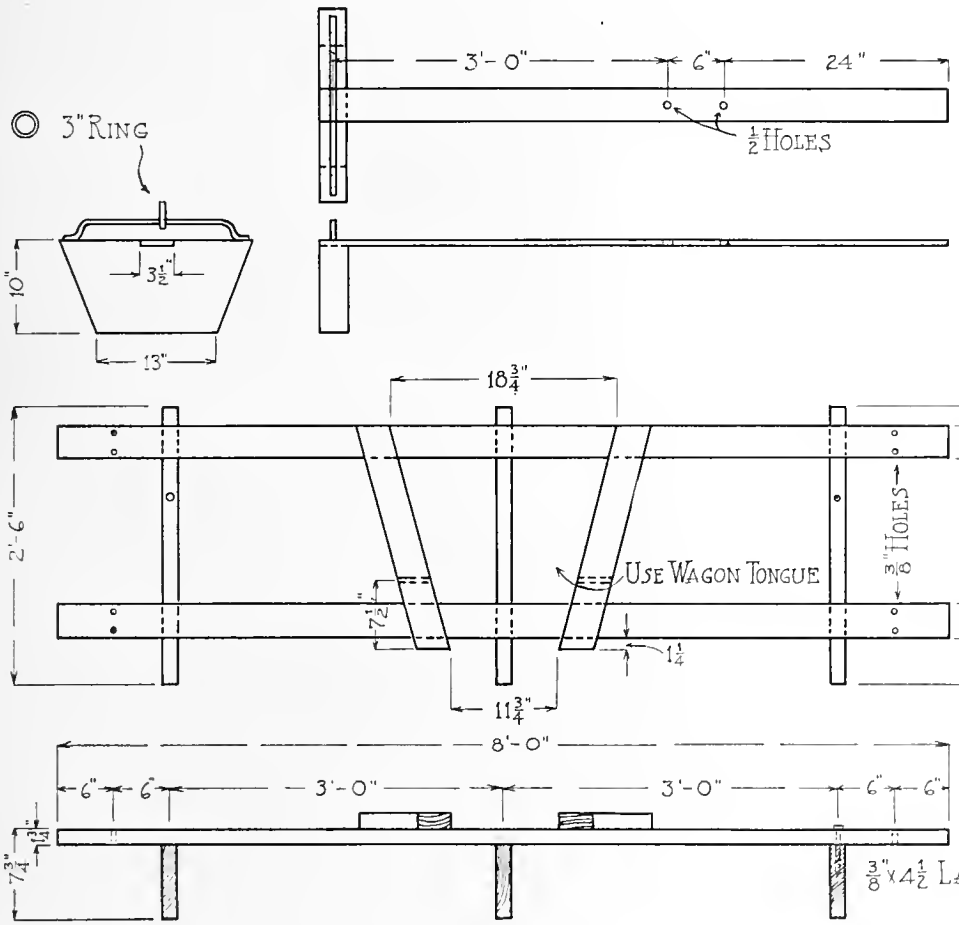
Bill of Stock. The bill of stock is almost identical with the above list of materials.

Tools. Saws, plane, chisel, rule, square, pencil, brace, $\frac{5}{16}$", $\frac{3}{8}$" and $\frac{1}{2}$" bits, monkey wrench and forging tools.

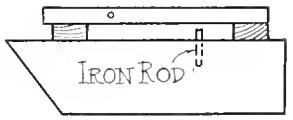
Directions. In making the runners measure back 6" on an edge and draw a line to the opposite corner, and saw. In making the other runners one sawing will make the slant for two runners. On the 8' crosspiece find the center, and with square draw a line across. Measure 3' and 3'6" on each side of this line and draw lines across, as in the middle. Bore two $\frac{3}{8}$" holes on each line. To shape the guide marker, measure in 4" on each edge and draw a line to the opposite corner. In the center on the upper edge measure $1\frac{3}{4}$" on each side of the point, and draw lines across. Saw down $\frac{7}{8}$" and chisel out the notch so as to let the $\frac{7}{8}$" marker extension bit flush with the surface. Nail this piece to the marker. Measure from the center of the marker 3" and 3'6" and bore $\frac{1}{2}$" holes in the middle. Make a 3" iron ring. Bend the iron rod as shown in the drawing; flatten each end, bore a $\frac{1}{4}$" hole at each end, and nail or screw to the marker, being sure that the ring is put in before nailing down permanently.

Assembly. Place the runners in position and put over these the crosspiece. Mark the holes and bore $\frac{5}{16}$" holes at each place. Put in the lag screws. Place the holders for the wagon tongue in position using the measurements shown in the drawing, but before nailing down, bore two holes for the wagon pin $7\frac{1}{2}$" from the front end. Bore a $\frac{1}{2}$" hole in the upper edge of the two outside runners in about the position shown in the top and end views in the drawing. Drive in a $\frac{1}{2}$" piece of iron leaving it to extend about 2" above the runner. The guide marker slips over this rod when in use.

In using the guide marker tie a small rope into the ring and a check at the other end to hook into the single-tree. This guide marker is taken off at each end of the row and placed on the opposite side.



POTATO MARKER
CHANGE TO 3'-6" HOLES FOR CORN



GARDEN MARKER.

Purpose. As the country is becoming more thickly settled, and farm work is getting to be more intensive; the truck farm and market garden is coming into a prominent place as a means of livlihood. This marker is designed for use on this kind of farm, and its convenience makes it well worth the trouble of making. By shifting the runners and fastening with the movable pins, any width row can be made.

Material.

(1) One piece 1¼"x7"x6' pine.
(2) One piece 1¼"x4"x2'.
(3) One piece 1"x4"x5'4".
(4) One piece 1¼"x6"x7'4".
(5) One piece 1"x4"x4'2".
(6) Four pins ⅜"x6".
A number of 8d. and 10d. common nails.

Bill of Stock. Finished dimensions.

(1) Three pieces 1¼"x7"x2' for runners.
(2) Three pieces 1¼"x1¼"x2' for tops of runners.
(3) Two pieces 1"x2"x5' for handles.
(4) One piece 1"x4"x2'10" for support for handles.
(5) 1¼"x3"x7'4" for runner stays.
(6) Two pieces 1"x2"x16" for braces.

Tools. Saws, planes, hammer, compass, brace, ⅜" bit, rule, try-square, spokeshave, knife, wood file and chisel.

Directions. Saw piece No. 1 mentioned in list of material into three pieces 2' long. Lay off and saw the 1½" x 3" notches shown in detail, in the drawing of the runners. Round off the end, beginning back about 6". Bevel the runner to a V-shape as shown in cross-section.

Bore holes as indicated in the drawing in the two runner stays in No. 5 in bill of stock. Finish piece No. 4, the support for the handles, as shown in the detail.

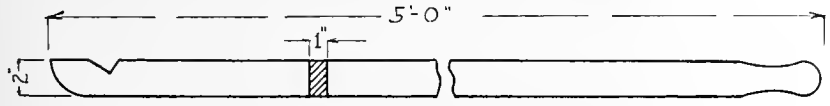
Work down handles as shown in detail, using spokeshave and file to round off the ends to be used for handles.

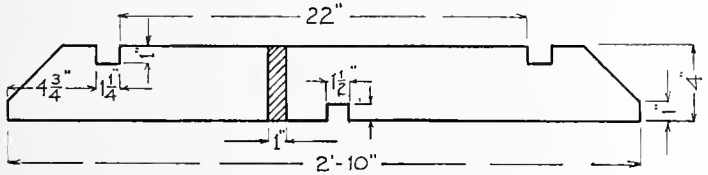
Make the pins from hard wood.

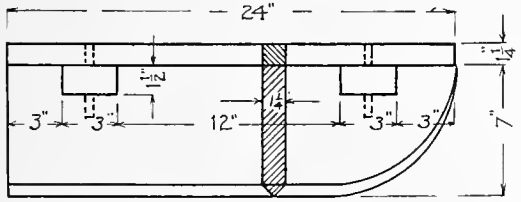
Assembly. Nail pieces mentioned in No. 2 in bill of stock to tops of the runners. Find center of piece immediately above each notch on the two outside runners. At this point bore a ⅜" hole thru the piece just nailed on and down two inches into the runner. These holes are for the pins which hold the runners in place.

Find the middle of the crosspieces, or runner stays, and nail the middle runner into position. Slide the other runners on and put pins in place. Nail on the support for the handles. Cut and fit the two braces. Put in place, and nail on the handles.

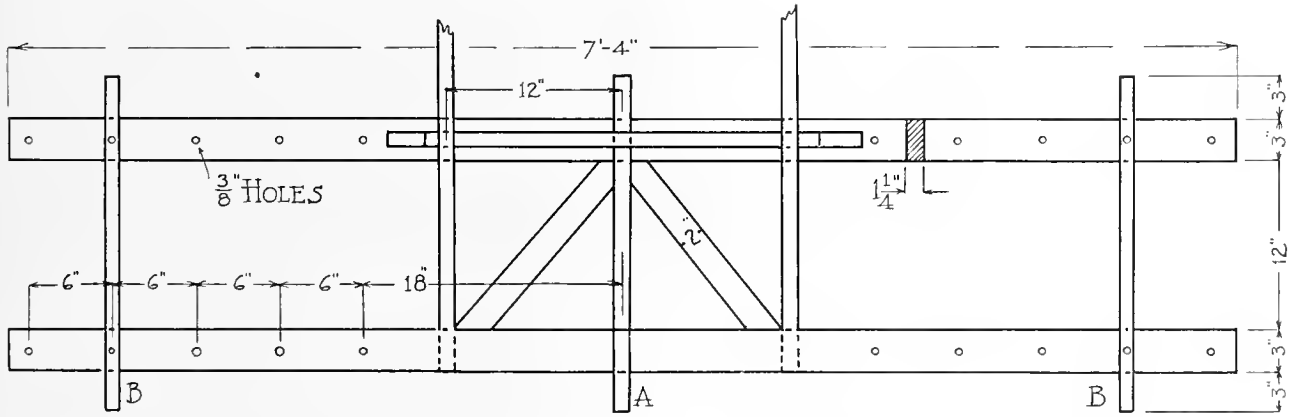
GARDEN MARKER

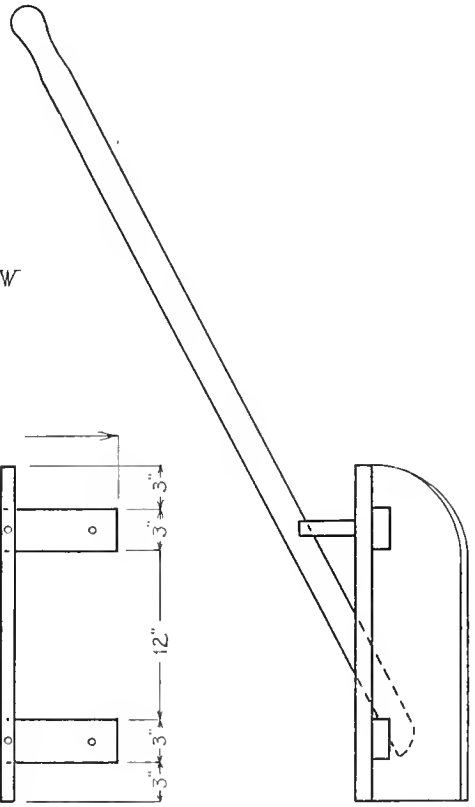






NOTE - 'A' REMAINS STATIONARY, 'B' 'B' MAY BE ADJUSTED FOR ANY WIDTH ROW





PORTABLE COLD FRAME.

Purpose. This cold frame can be used advantageously in any climate where the winter temperature is below the growing point for plant life. In southern climates green things such as lettuce, radishes, mustard, spinach, and even tomatoes, can be grown during the entire winter. A woman in Dallas, Texas, supplies her twenty and more boarders with green things all winter long, with a cold frame less well built than the one given here.

In the more northern climates seeds are planted before the frost is gone. The sun shining thru the glass warms the ground, accumulationg enough heat to prevent injury from tolerably hard freezes. More protection still is given if manure is packed around the frame. Cabbage, tomato, celery and such plants are much sturdier if started in the cold frame. They can be accustomed gradually to the out door air before transplanting. All flowering plants which are transplanted such as salvia, pansies, asters, etc., grow much stronger if started in the forcing box. There is a great deal of genuine pleasure, and a great deal of profit in the use of this box.

It is an easy matter to get hold of some old window sashes or storm windows. The size of the window frame used will determine the size of the box, the lower part being made to fit the frame. This box may be moved about easily, and is stored away when not in use. With ordinary care it will last for years.

Material. Pine.

Two pieces ¾″x8″x14′.
One piece ¾″x8″x12′.
One piece 2″x4″x6′.
One piece ¾″x10″x14′ shiplap.
One piece ¾″x6″x10′.
Two storm windows 2′6″x4′6″.
Three pairs 2″ butt hinges.
A number of 8d. common nails.

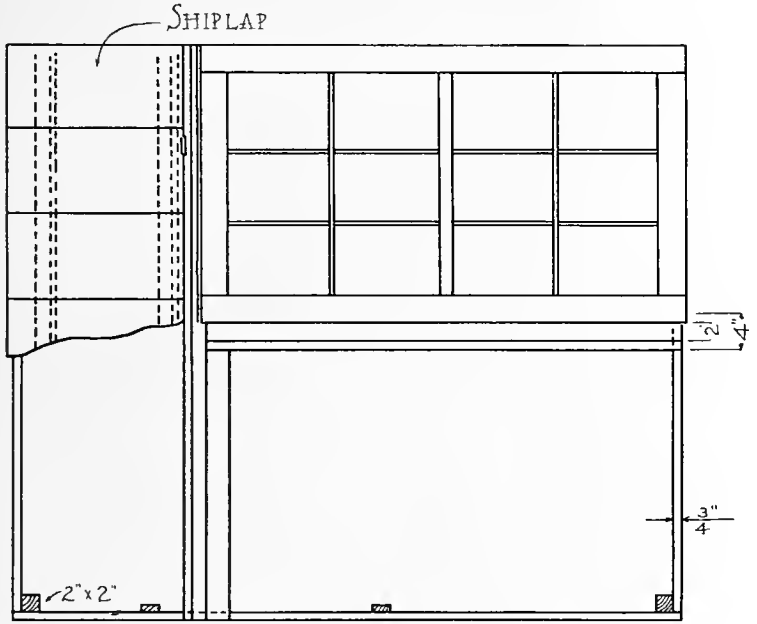
Bill of Stock. The bill of stock may be easily made from the drawing, and should the size of windows differ, the bill for this particular frame would not suffice.

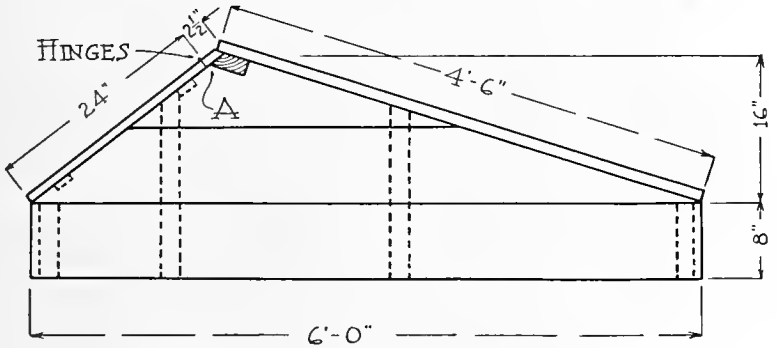
Tools. Saws, plane, square, try-square, rule, pencil, gage, and hammer.

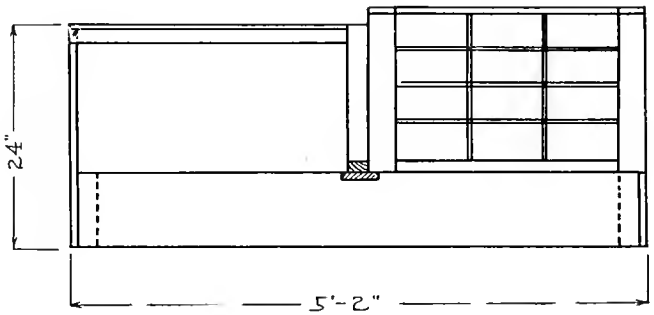
Directions. Saw and plane all pieces except the sides to dimensions given in the drawing. To lay out one of the sides lay down on the floor three 8″ boards, the lower one being the correct length. The second board must be about 7′ long to make both the second and third boards without waste of material, the long cut making the long side for both pieces. The third 8″ board, while laying off, may be any length. Measure in from one end 21″, and with framing square, draw a line across. Connect this point with top corner of the first board. Saw the short cut and then the long cut. Turn this long cut over and re-mark to get the complete side. The other side is made in the same way. Saw out notches at the ridge point for the crosspiece 1¾″x 3½″ as shown in the drawing. Bevel the piece last mentioned to conform to the slope of the roof.

Assembly. Nail the side pieces together placing the inner nail tie in about the same position as shown in the drawing. Nail in the corner pieces and also the front and back pieces. Nail together the two pieces between the windows. Cut a 4″ notch in the front and upper pieces deep enough so that the bottom piece will come flush with the edge and nail into position. Nail the door together, nailing the shiplap to the under crosspieces. Nail on the piece marked A in the drawing. Put the hinges on the door and fasten them to the piece just nailed. Fasten on the storm windows with hinges. It is necessary that these windows, as well as the door, be raised at times in the middle of the day to keep the plants from growing too rank.

PORTABLE COLD FRAME







HOG TROUGHS.

Purpose. This article is used on every farm, and it affords a problem in accurate joining and stability. The second trough is more sanitary, being easily cleaned, and it allows animals to get their food more easily.

Trough No. 1.

Material.

Two pieces 1¾″x6″x12′.
One piece 1¾″x6″x4′.
One piece 1¾″x8″x12′.
One piece ⅞″x4″x11½″.
Some white lead, a number of 20d. common nails.

Bill of Stock. To be made by the pupil.

Tools. Saw, plane, pencil, hammer, chisel, and square.

Directions. Cut pieces to dimensions given in drawing. In sawing take unusual care to square the ends in the long pieces, using plane if necessary. Plane good straight edges on the 8″ piece.

Assembly. Put white lead on all joints before nailing. Nail together the long pieces forming the trough, then nail on the ends. Saw and chisel out a space for crosspiece in the middle, making it come flush with the upper surface. Nail on the crosspiece.

Trough No. 2.

Material.

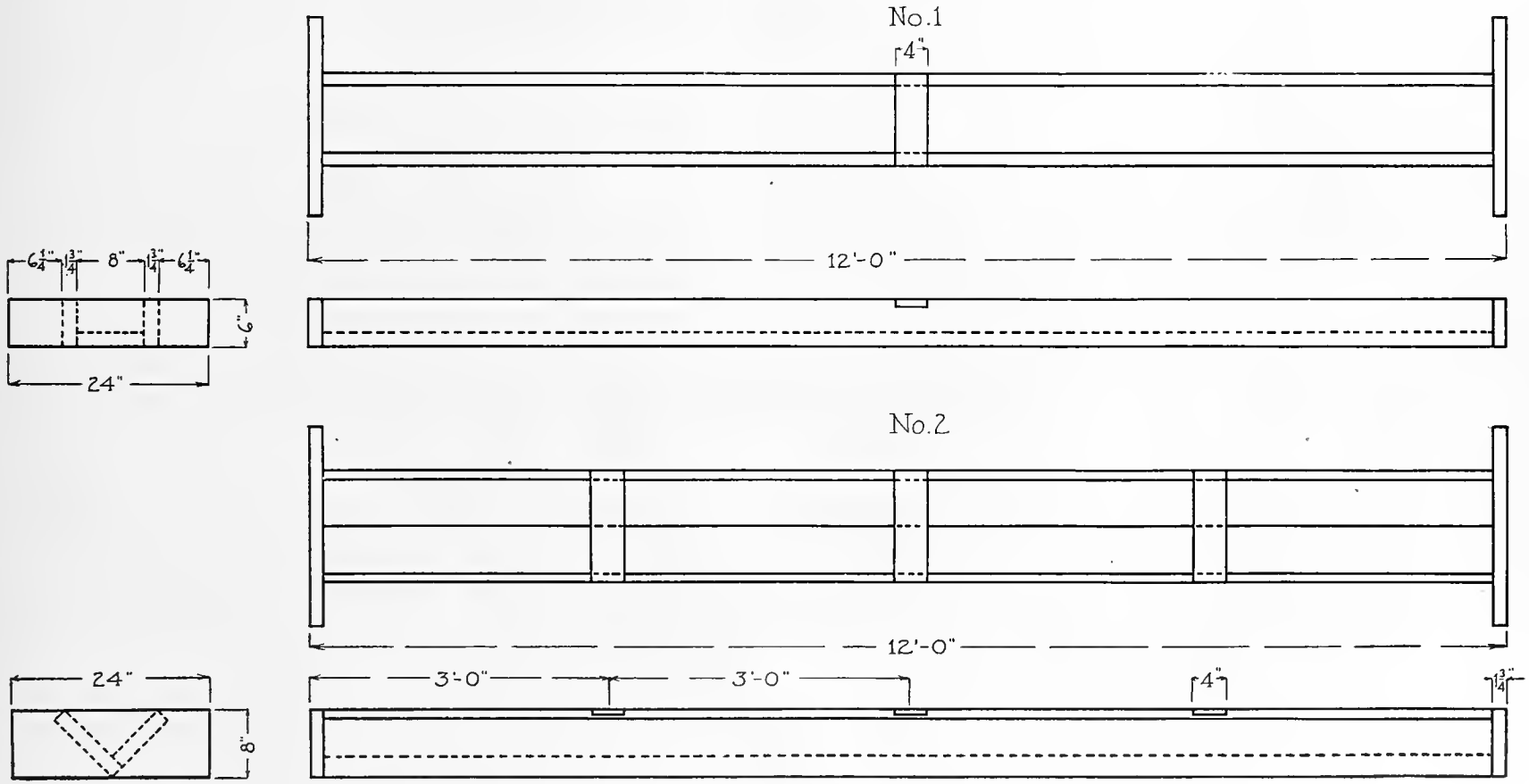
One piece 1¾″x10″x12′.
One piece 1¾″x8″x16′.
One piece ⅞″x4″x3′3″.
Some white lead and a number of 20d. common nails.

Tools. Same as preceding problem.

Directions. Cut the material into pieces as shown in the drawing. Square the ends of the long pieces very carefully. Plane one good straight edge on the 8″ plank so that it will make a good joint. Test the joint before nailing.

Assembly. Use white lead in all joints. Nail the 8″ and 10″ planks together, then nail on the ends. Saw and chisel out spaces for the cross-ties. These cross-ties should come flush with the upper surface.

HOG TROUGHS



GRAIN TROUGH FOR FEEDING SHEEP.

Purpose. This grain trough does away with the wasteful method of feeding grain on the ground or floor where it becomes trampled and dirty. The trap-door enables a man to feed from the top and close it down again. It also prevents the sheep from crawling into or jumping over the feeding trough and overturning its contents. This trough will accommodate quite a number of sheep, since they may feed from both sides. It is very simple in construction.

Material.

One piece 7/8"x12"x12' yellow pine.
One piece 7/8"x12"x16'.
One piece 7/8"x8"x12'.
Two pieces 2"x4"x12'.
Three 3/4"x2" butt hinges.
A number of 8d. and 10d. common nails.

Bill of Stock. Finished dimensions.

One piece 7/8"x12"x12' for bottom.
One piece 7/8"x8"x12' for top.
Three pieces 7/8"x4"x12' for door and sides.
Three pieces 7/8"x12"x10½" for ends and partitions.
Six pieces 1¾"x3½"x22" for legs.
Four pieces 1¾"x3½"x3' braces for legs.

Tools. Saws, plane, square, pencil, T-bevel, hammer and chisel.

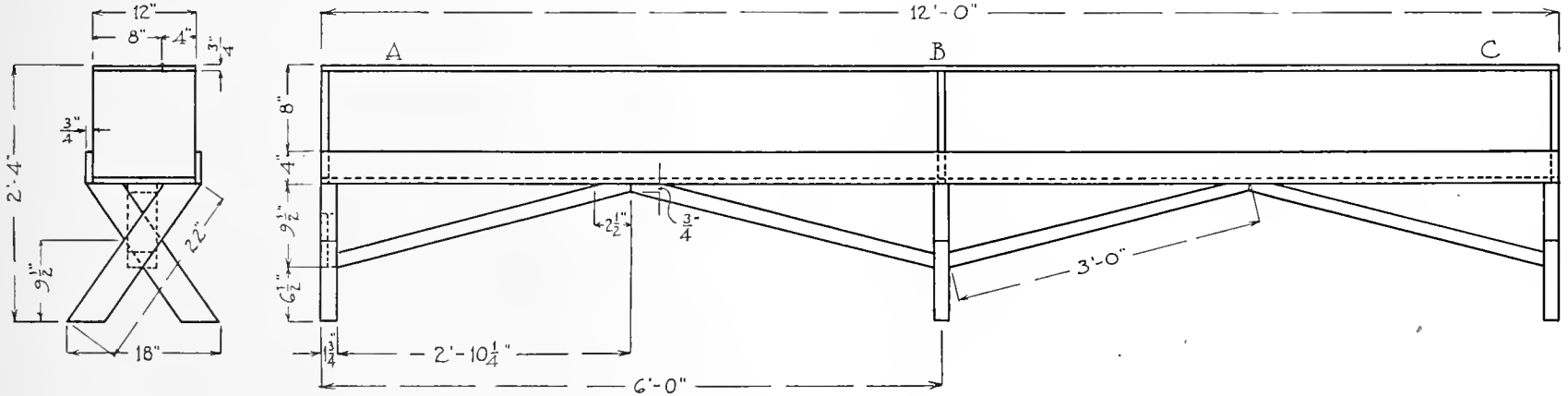
Directions. Make the legs from one of the pieces of studding. Use 15¾" on one arm of the square and 16" on the other to get the angle for sawing the leg. The entire length is 1' 10". Using the square, lay off angles and saw. Make a cross-lap joint so that a line drawn thru the center of the joint horiontally will be 9½" from the ground. An easy method to mark out this joint is to put one piece over the other to the correct dimensions, marking with a knife or sharp lead pencil and sawing to the inside of the lines. Saw the braces for the legs. Rip-saw a 12" board 12' long into two boards, one 8" and the other 4" wide. Rip the 8" board into two equal parts. Saw the 16' board into one piece 12' long and three pieces 10½" long.

Assembly. Assemble the trough part first. Nail the two 4" side pieces to the bottom board. Nail in the ends and the middle partition. Nail the box to the legs and put on the lower braces. Lastly put on the 8" top piece leaving the 4" piece free for hinges. Put in the hinges.

This trough should be put together very firmly as it is likely to have quite rough usage.

GRAIN TROUGH FOR FEEDING SHEEP

HINGES TO BE PUT AT A-B-AND C.



FEEDING TROUGH FOR STOCK.

Purpose. This feeding trough is a necessity because of its convenience, cleanliness, and economy. It should be found on all stock and dairy farms. The material used is strong and heavy to prevent the trough from being overturned by the cattle. Rough-sawed oak from the mill, hard pine, or any good substantial wood may be used, and if well built it will last for years.

Material.

(1) Five pieces 2″x10″x16′.
(2) One piece 2″x10″x7′.
(3) One piece 4″x4″x17′.
(4) Two pieces 2″x6″x12′.
(5) One piece 2″x6″x14′.
(6) A number of 20d. common nails and two dozen ½″x6″ bolts. (The bolts may be omitted but they make a more substantial trough.)

Bill of Stock. The bill of stock may be easily made by studying the drawing carefully.

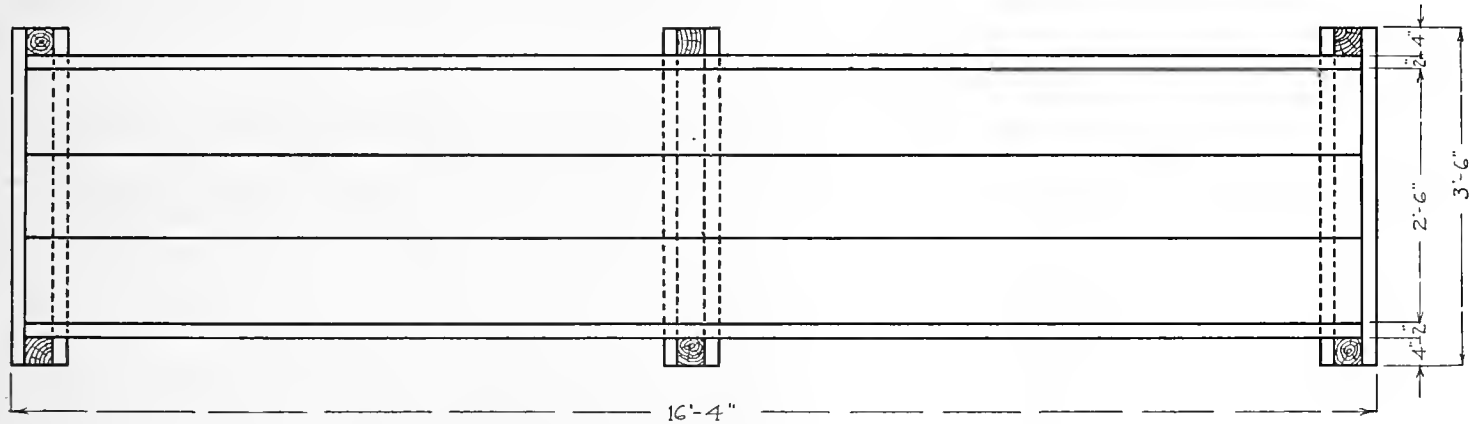
Tools. Saws, square, rule, pencil, heavy hammer, brace and ½″ bit.

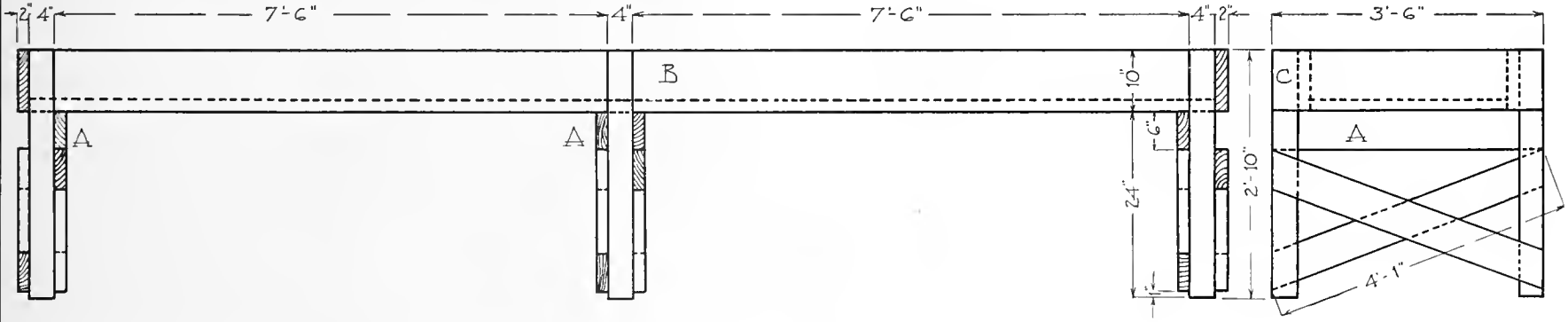
Directions. Square up and cut all pieces except braces. Cut six pieces 4′ 1″ long from No. 4 in list of material. You will notice that you are to cut three 4′ 1″ pieces from a 12′ plank. This may be done by laying out all pieces before sawing so as to allow for slant.

Assembly. Lay two legs on the floor 3′ 6″ apart outer measurements. Measure down 10″, and nail on a crosspiece, as A. Nail on the braces. Put one bolt in each joint. Complete the other sets of legs in the same way, making three sets.

Stand the legs upright or on the side and nail on B, as shown in drawing, flush at each end, nailing the third set of legs in the middle. Nail on opposite board. Nail in the floor of the trough and lastly the ends, marked C in the drawing. Put a bolt in each leg thru side and end pieces marked B and C in the drawing.

FEEDING TROUGH FOR STOCK





UNLOADING CHUTE.

Purpose. This drawing shows a portable, substantial unloading chute that should be found on every farm where hogs are raised for market. It is made especially strong so that it may be used also for cattle. The important thing in a chute is a strong floor. If it springs, the animals hesitate and if it is weak and breaks thru, there is danger of a broken leg.

Material. Floor and supports oak if possible, altho a good grade of yellow pine will do.

Three pieces 1¾″x12″x8′.
One piece 1¾″x6″x14′.
One piece 1¾x6″x8′.
Three pieces ⅞″x8″x16′.
One piece 2″x4″x16′.
Two pieces 2″x4″x12′.
One piece ⅞″x6″x9′.
A number of 10d., 16d. and 20d. common nails, also some 1½″ No. 9 flat head screws.

Bill of Stock. Finished dimensions.

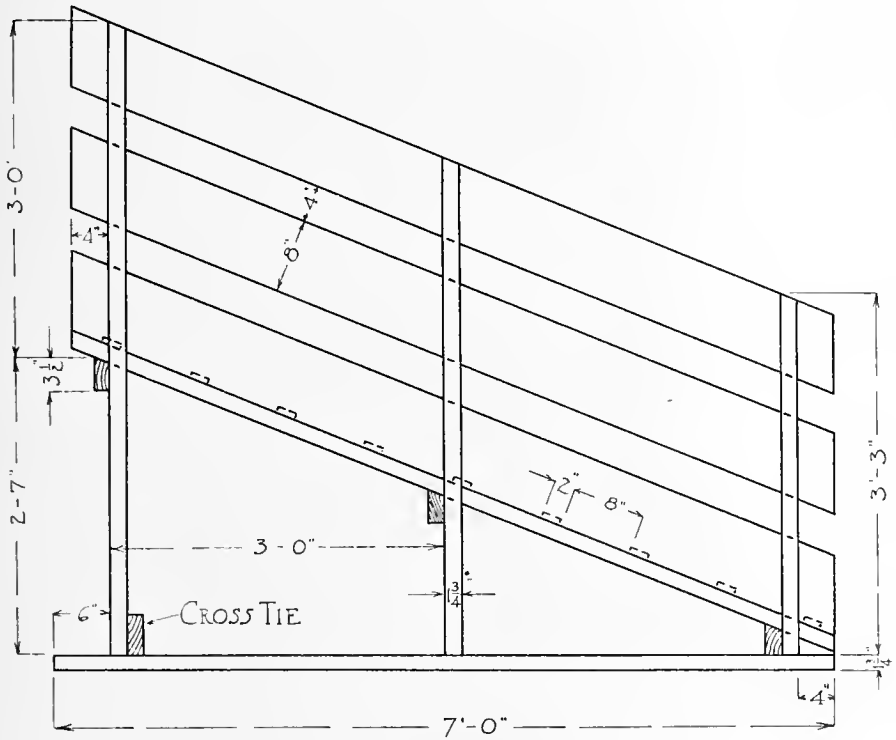
(1) Three pieces 1¾″x12″x7′5″ for floor.
(2) One piece 1¾″x6″x7′5″ for floor.
(3) Two pieces 1¾″x6″x7′ for foundation.
(4) Four pieces 1¾″x3½″x4′1″ for cross ties.
(5) Two pieces 1¾″x3½″x5′7″ for front uprights.
(6) Two pieces 1¾″x3½″x4′5″ for middle uprights.
(7) Two pieces 1¾″x3½″x3′3″ for rear uprights.
(8) Six pieces ¾″x8″x7′8″ for siding for chute.
(9) Nine pieces ¾″x2″x3′ for cleats.

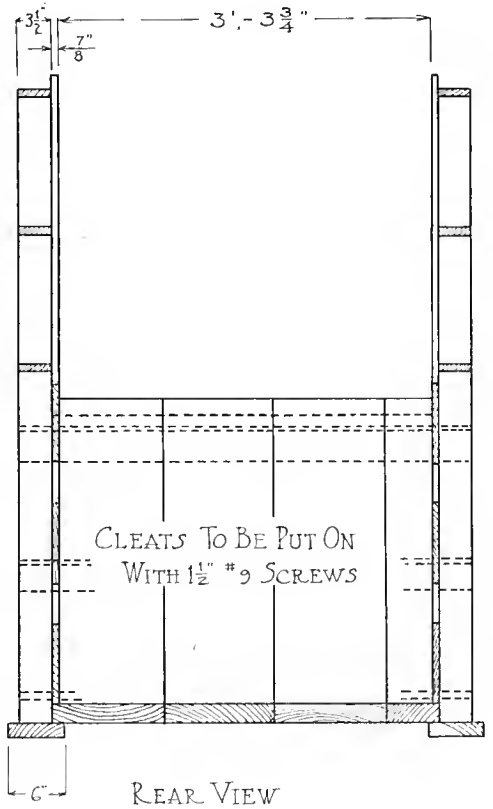
Tools. Saws, plane, rule, square, pencil, gage, T-bevel, and hammer.

Directions. Saw Nos. 3 to 7 inclusive to the lengths given in the bill of stock. Set the T-bevel to an angle on the square of 3″ to 7″. (See illustration on Plate 2.) Plane three of the cross-ties, No. 4 in bill of stock, on one edge to this angle. These are to fit up under the floor. Use this same angle in sawing the upper ends of Nos. 5, 6 and 7 in bill of stock. After pieces, No. 8 in bill of stock, have been measured to length set the T-bevel to these and draw angles for sawing, likewise the ends of the flooring.

Assembly. Nail a beveled cross-tie, No. 4 in bill of stock, to the rear uprights at the lower end, and with the bevel in the position shown in the side view of the drawing. Likewise nail on the crosspiece on the front uprights the upper edge of the bevel being 2′ 7″ from the lower end. Nail on the crosspiece at the bottom of these same uprights. Place the 2″ x 6″ pieces on the floor and toe-nail the rear uprights to these, placing them in 4″ from the end. The front uprights are placed 6″ from the end and toe-nailed. (Brace them temporarily if necessary.) After being sure that the uprights are vertical by using a level, place one of the pieces of flooring in place and put a nail in each end. Repeat this at the other side. Toe-nail in the middle uprights at the places designated in the drawing. Hold the cross tie up to the flooring and nail. (This is done in this manner to make sure that there will be no spring, or give, to the floor.) Nail in the remaining pieces of flooring. Nail on the siding for the chute, the first piece fitting flush with the floor, and a 4″ space between each of the other pieces. Put on the cleats with screws, allowing 8″ space between each.

UNLOADING CHUTE





REAR VIEW

INDIVIDUAL HOG COT.

Purpose. The best hog raisers of today are beginning to recognize the need of individual houses for sows with pigs. They can be better cared for and each mother is less likely to lie on her pigs. The little pigs are kept more apart from the other litters and from the mature hogs in the lot.

Material. Yellow pine.

Two pieces 4″x4″x8′.
Five pieces 2″x4″x14′.
Four pieces 2″x4″x16′.
Fifteen pieces ⅞″x10″x14′ shiplap.
Seven pieces ⅞″x12″x8′.
One piece glass 6″x9″.
A number of 8d., 10d., 16d. and 20d. common nails.

Bill of Stock. It is only necessary to work out the pieces as the work proceeds.

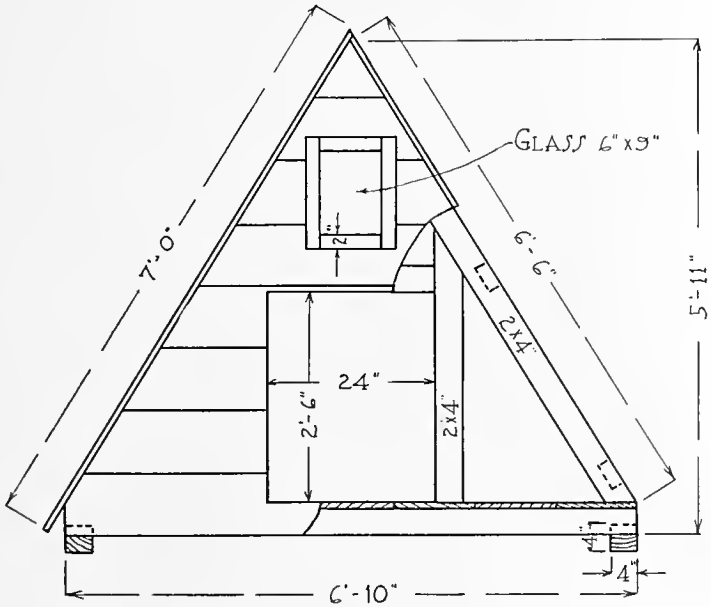
Tools. Saws, plane, square, rule, pencil, hammer and chisel.

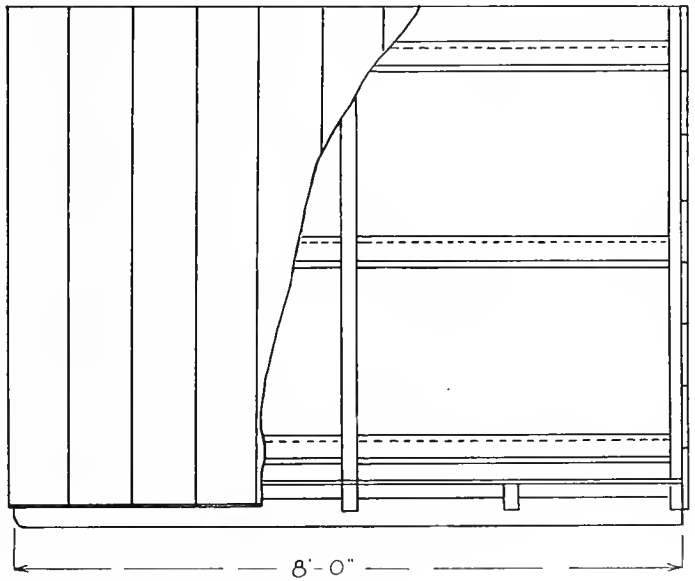
Directions and Assembly. The two 4″ x 4″ pieces are used for runners. The 2″ x 4″ pieces for the floor foundation are set down 1¾″ into the 4x4, one across each end, one across the middle and one in the middle of the two spaces thus formed. Lay off the joints 1¾″ wide and 1¾″ deep; saw and chisel out the wood. Place the pieces in position, and nail. Nail on the floor. The rafters are 6′ 6″ long—the longest edge. In laying out the rafters use 9¼″ on one arm of the square and 16¾″ on the other arm, using the square at one end 9¼″ to 16¾″, and at the other end 16¾″ to 9¼″. Nail the rafters in place. Cut the cross-ties between the rafters and nail them into positions shown in the drawing. Next, make the frame for the opening. Square one end, and, setting it into place on the floor, and up against the rafter, mark and saw, and then nail in place. In a like manner mark and saw the other side, putting in the overhead piece last. Put the shiplap on the back end first, so as to use the small pieces on the front.

Take advantage of the slant wherever possible in using small pieces. Board across the small opening in front, and later cut out the space for the glass and make the small casing. Nail on one side of the roof first, sawing it with the same bevel as the slant on the roof, so that the roof ridge is well fitted and tight.

INDIVIDUAL HOG COT

A DOOR TO FIT OPENING MAY BE MADE
IF NECESSARY - ALSO AN OPENING
ON REAR FOR VENTILATION, SAME
POSITION AS WINDOW





MILKING STOOLS.

"Little Maid, pretty Maid, whither goest thou?"
"Down in the meadow to milk my cow."
"May I go with thee?" "No, not now,
When I send for thee, then come thou."

Stools 1 and 2 are much alike. No. 3 is a round-top, three-legged stool well suited to milking outside, since the three legs easily adjust themselves to any unevenness of the ground. No. 4 furnishes also a platform for the milk pail, lessening the chance for dirt getting into the pail.

No. 1.

Material.

One piece ¾″x8″x3′ pine.
Twenty-two 1½″, No. 9, flat head screws, or as many 8d. common nails.

Bill of Stock. Finished dimensions.

One piece ¾″x8″x10″ for seat.
Two pieces ¾″x8″x9¼″ for legs.
Four pieces ¾″x1″x6″ for braces.

Tools. Saws, plane, T-bevel, try-square, screw-driver, gage, rule, pencil, countersink, brace, and $\frac{7}{32}$″ twist-drill.

Directions. Cut pieces to dimensions shown in bill of stock. Set T-bevel to 45° angle, mark and saw braces.

Assembly. Put top and legs together first, then put in braces.

No. 2.

Stool No. 2 is so nearly like stool No. 1 that the pupil may make out the working data for the entire problem, beginning with the list of material and including bill of stock, tools needed, directions for making and assembling.

No. 3.

Material.

One piece 1½″x10″x10″.
One piece 1½″x1½″x2′6″.
Glue.

Bill of Stock. Finished dimensions.

(1) One piece 1½″x10″x10″ for round top.
(2) Three piecees 1½″x1½″x10″ for legs.

Tools. Saws, chisel, spokeshave, T-bevel, brace, 1″ bit, dividers, compass, coping saw, drawknife and rule.

Directions. Draw diagonal lines on both sides of piece No. 1 mentioned in bill of stock to find center. Set the dividers to 5″, and draw circle. Cut to line with coping saw. On opposite side draw a circle with a radius of 2½″. Set T-bevel on the square at an angle ⅝″ to 4¾″. (See illustration Plate II.) With the compass divide the circle into three equal parts. At these points bore three 1″ holes 1″ deep at the angle of the T-bevel.

Find the center of one end on each leg, and with the compass set at ½″ radius, draw circles. Using the drawknife shave down to these circles, beginning about 2½″ down. Finish with spokeshave. At opposite ends of the legs plane off to the angle set on the T-bevel.

Assembly. Put glue in the holes and on ends of legs. Push in the legs. Let the glue set before using the stool.

No. 4.

Material.

One piece ¾″x8″x5′6″ pine.
Thirty-two 1½″, No. 9, flat head screws.

Bill of Stock. To be made out by pupil.

Tools. Saws, plane, try-square, pencil, screw-driver, brace, 7/32″ drill, countersink and rule.

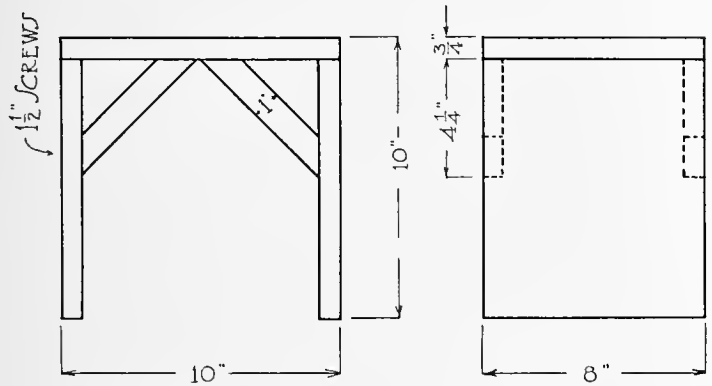
Directions. Cut from the 8″ board all pieces shown in the drawing. Lay off, bore, and countersink holes for screws.

Assembly. Screw the legs to both seat and platform for pail. Turn stool over and screw on opposite legs. Screw braces into place to give stability to stool.

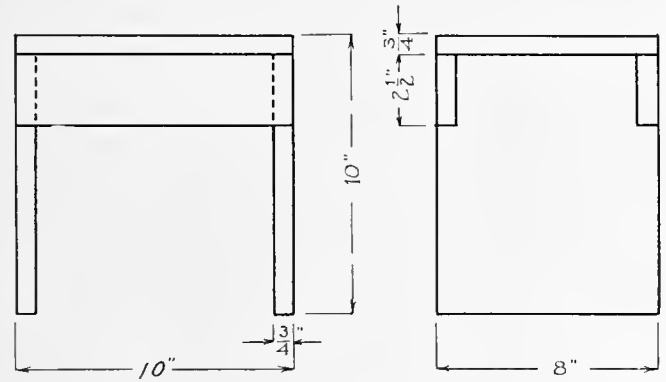
PLATE 43

MILKING STOOLS

No 1

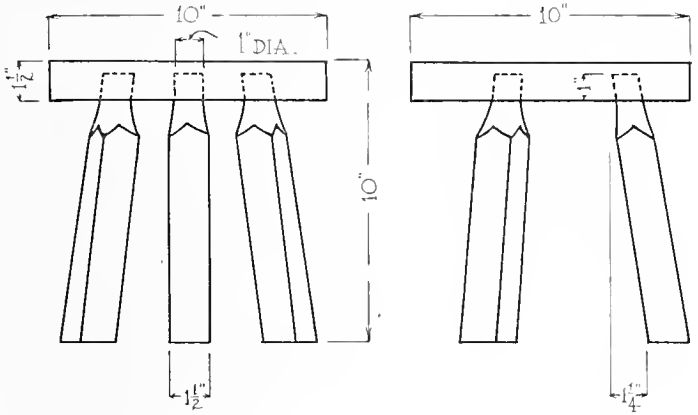


No. 2

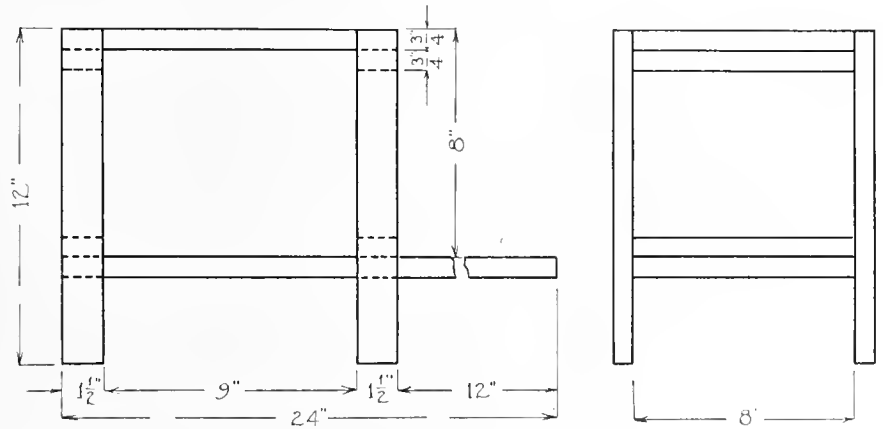


THREE LEGGED ROUND TOP

No 3



No. 4



NECKYOKE, SINGLETREE, AND EVENER.

Purpose. These problems will be of great benefit to any one using horses. These pieces are often broken, and the ability to make them on short notice is most valuable. When made in the farm shop, the workman can select only the very best material, which should be entirely free from knots and cross-grained wood.

Neckyoke.

Material.
One piece 2⅛″x2⅞″x3′2″ hickory or oak.

Bill of Stock. Finished dimensions.
2″x2¾″x3′1¾″.

Tools. Saw, plane, gage, rule, spokeshave, compass and wood file.

Directions. Square up material to dimensions given in the drawing. This forms a piece of wood 1⅞″ square at each end, with a 2″ x 2¾″ rectangle in the middle. In planing the ends to get the 1⅞″ square, plane ¼″ off of the upper surface of ends and ⅝″ off of lower surface. This leaves about ⅛″ extra width at ends which may be planed to right size. Draw a circle 1⅞″ in diameter on both ends. Plane this piece to an eight-sided figure, then begin to round by shaving and filing off the sharp edges.

Singletree.

Material.
One piece 2″x2¾″x2′10¼″ oak or hickory.

Bill of Stock. Finished dimensions.
One piece 1¾″x2⅝″x2′10″. Finished dimensions.

Tools. Same as for neckyoke.

Directions. This is exactly the same problem as the neckyoke with different dimensions. Square up material to dimensions given in the drawing. Draw circles of 1½″ diameter at each end and shave down to eight sides. Shave off sharp edges and file smooth.

Evener.

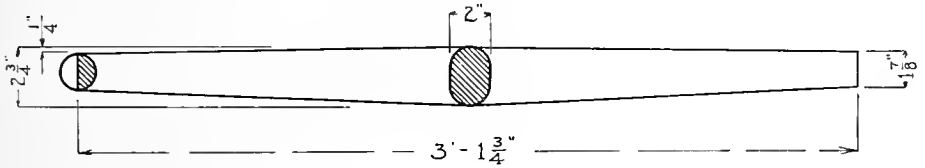
Material.
One piece 1¾″x4¾″x4′ white oak or hickory.

Bill of Stock. Finished dimensions.
One piece 1½″x4½″x4′.

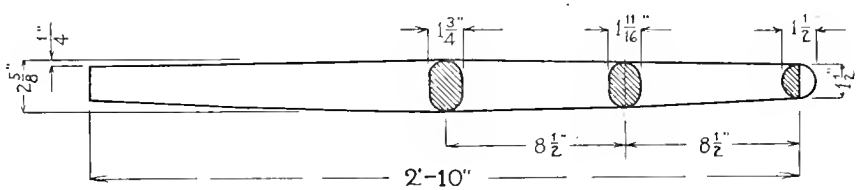
Tools. Saw, plane, gage, rule, spokeshave, brace, ¾″ and ¼″ bits, wood file and chisel.

Directions. Square up material to dimensions given in drawing. Lay off and bore the middle hole 1¾″ in from the straight edge. Bore the two ¾″ holes 2½″ from each end, and 9/16″ in from the slanting side. At each end bore a ¼″ hole, perpendicular to the ¾″ hole. These should be 1½″ from the end. Bolts are put thru these holes to keep the ends from splitting. Chamfer ends and corners where shown in drawing.

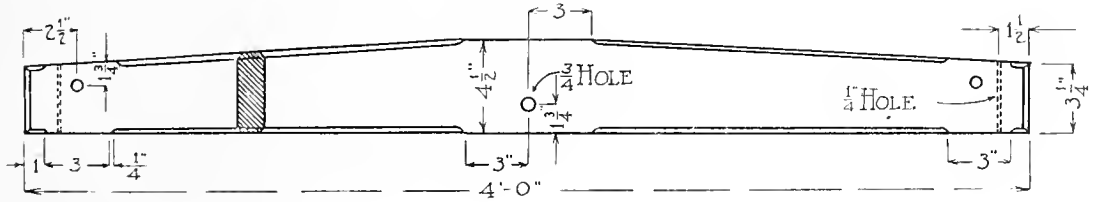
NECKYOKE



SINGLETREE



EVENER



WAGON BOX.

Purpose. This wagon box is made for a grain box, but may be used for general purposes. The problem may seem a little large but the author has had as many as eight of these made by pupils in a single year.

The box beneath may be made separate from the side boards. It is possible to construct the entire box, including the rods, side braces and irons, but these can be bought almost as cheap as the material will cost, so it is advisable to buy them, the construction and assembling of the box beneath being a big undertaking in itself.

Material. For bottom box.

Two pieces 7/8″x14″x14′ white pine or hickory.
One piece 1½″x3½″x16′ hickory or oak.
Twelve pieces 7/8″x4″x12′ fir flooring.
One piece 7/8″x8″x12′ white pine.
Two 3/8″ wagon rods.
One set, eight pieces, of wagon box strap bolts with nuts.
Six 3/8″ wagon box side braces with nuts.
A number of assorted 1½″, 2″ and 2½″ wagon box 1/4″ oval head rivets.
One pair 2″ hinges for back end gate.
Six feet of 3/16″x1″ wrought iron.
Twenty-eight feet of 3/32″ iron as shown at X, plate 46.
An assortment of nails.

Material. For top box.

Two pieces 7/8″x10″x14′ white pine.
One piece 7/8″x8″x6′6″.
Two 3/8″ wagon box rods.
Twenty-eight feet of iron as shown at X, in detail.
An assortment of 2″ and 2¾″ wagon box 1/4″ oval head rivets.
An assortment of nails and screws.
If desired, 27′ of 1/16″x1¼″ iron as shown at A, in detail.

Bill of Stock. Lower box. Finished dimensions.

(1) Two pieces 7/8″x14″x10′9″ for sides.
(2) Two pieces 7/8″x14″x3′1¼″ for end gates.
(3) Three pieces 1½″x3½″x4′ for crosspieces.
(4) One piece 1½″x3½″x3′2″ for front crosspiece.
(5) Two pieces 7/8″x3½″x2′10″ for K.
(6) Two pieces 1½″x1½″x3′2″ for L.
(7) Twelve pieces 7/8″x4″x10′9″ for flooring.
(8) Four pieces 7/8″x3″x14″ for crosspieces on end gate.
(9) One piece 7/8″x6½″x3′2″ for foot rest.
(10) Four pieces 7/8″x2¼″x14″ to make slot for end gates.
(11) Four pieces 7/8″x2¼″x12″ to make slot for end gates.

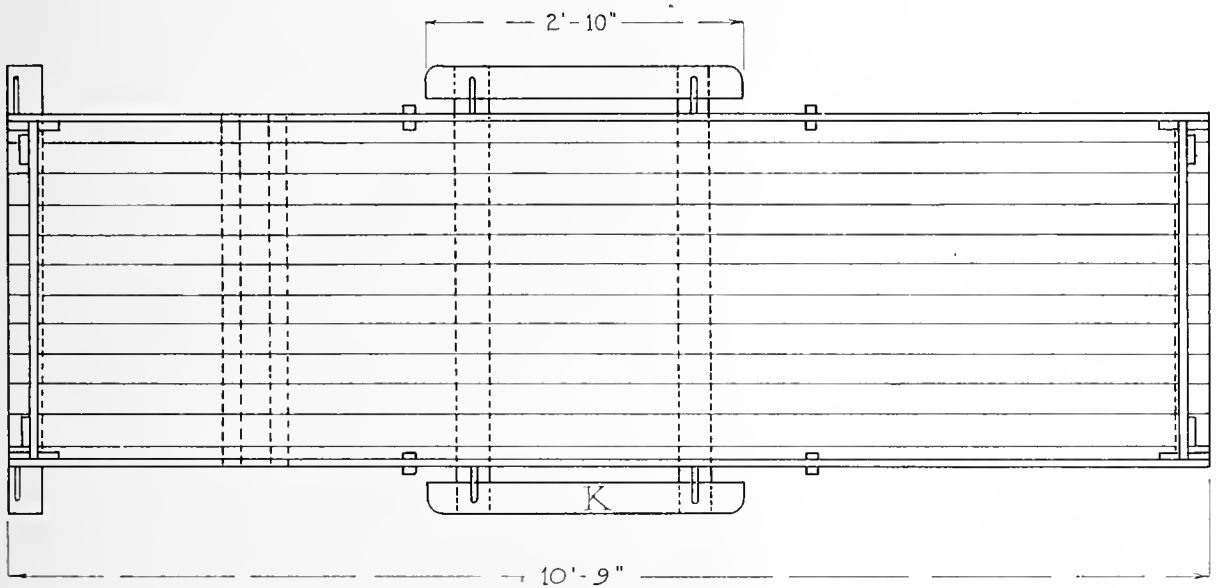
Top box.

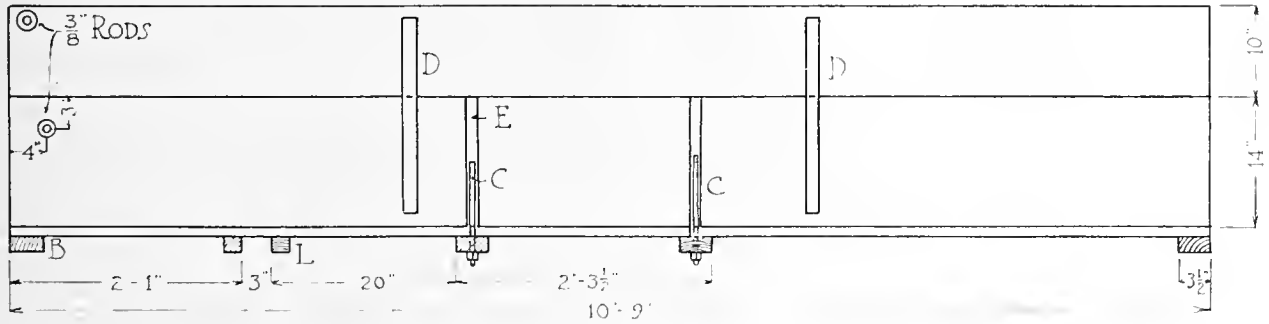
Two pieces 7/8″x10″x10′9″ for sides.
Two pieces 7/8″x10″x3′1¼″ for end gates.
Four pieces 7/8″x3″x10″ to make slots for end gates.
Four pieces 7/8″x2¼″x12″ to make slots for end gates.
Eight pieces 7/8″1½″x12″ for D.

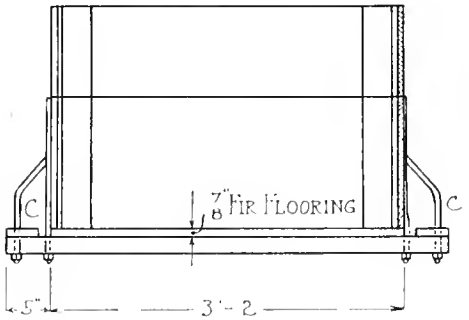
Tools. Saw, plane, square, rule, pencil, brace, 1/4″, 3/8″ and 5/8″ bits, forge shop tools, gage, wood file, chisel, riveting hammer and hammer.

Directions and Assembly. The cross braces, Nos. 3 and 4, in bill of stock should be made first, the back one being finished as shown in the detail sheet. Lay off 38″ (this being the width of the box) and bore holes just outside of this line for the strap bolts. Also bore holes where needed for side braces. Plane down the groove edge of one of the pieces of fir flooring. Lay the under crosspieces at the places shown in the drawing and put on the flooring, ripping the last piece so that the edge will be even with the edge of the hole. Mark a line across each end and saw off the extra pieces of flooring. Saw the sides to length and rivet on strap bolts, being careful to leave out the rivets where the side braces are placed. It is best to rivet these over an anvil or heavy piece of flat iron. Now rivet on the cleats that hold the end gates in place, being careful in each case not to put a rivet where the rod is to be. Nail on the steps and bore holes for side braces. Bolt the sides in place, put in the side braces and finish riveting.

WAGON BOX


2'-10"
K
10'-9"

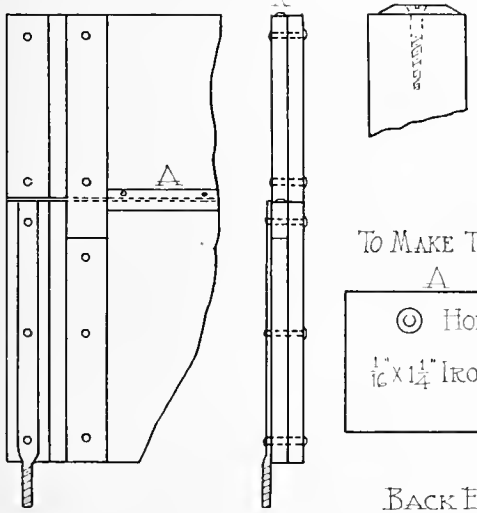

3/8" RODS
4"
3"
D
D
E
C
C
B
L
10"
14"
2'-1"
3"
20"
2'-3 1/2"
3 1/2"
10'-9"


C
7/8" FIR FLOORING
C
5"
3'-2"

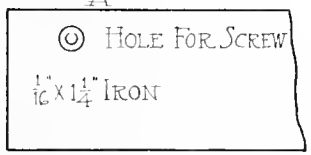
The front end gate is made as shown in the detail, none of the riveting being done until the iron work has been completed and the foot-rest made. The back end gate is made as shown in the detail, the board being sawed into two pieces 12″ from the right hand end. Nail the extra piece to the smaller piece, and put a pair of hinges on the inside. An iron button should be made for M in the drawing to hold the end gate together. This button is shown at N. Bore the holes and put in the rods. Give the box two good coats of paint.

The construction of the top box is almost a repetition of the lower box except that wooden cleats are used instead of strap bolts shown as D in the detail sheet. These cleats are riveted to the top side boards. Rods and pieces are put on to hold the end gates as in the lower box.

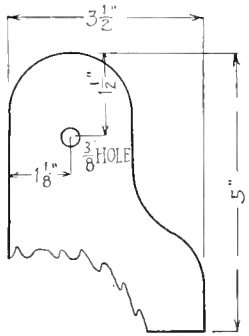
WAGON BOX
DETAIL SHOWING CONSTRUCTION



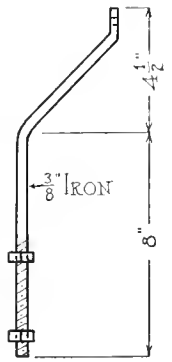
TO MAKE TIGHT GRAIN BOX

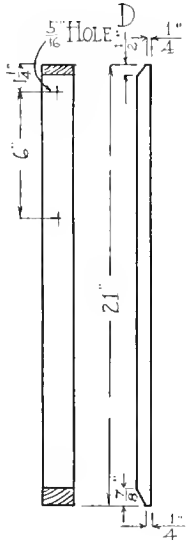


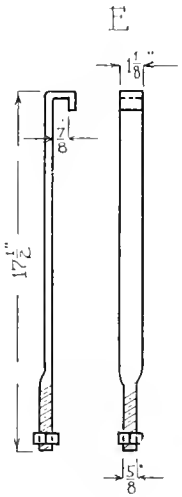
SUGGESTION FOR FINISHING B



SIDE BRACES

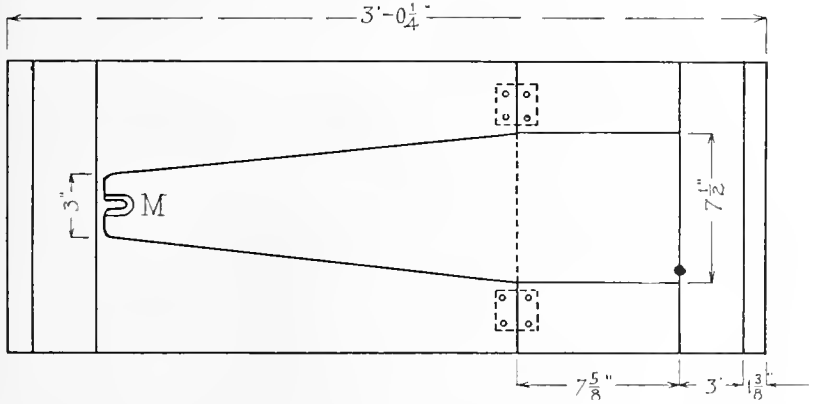


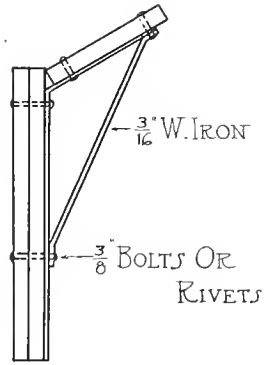




FRONT END GATE SHOWING FOOTREST

BACK END GATE





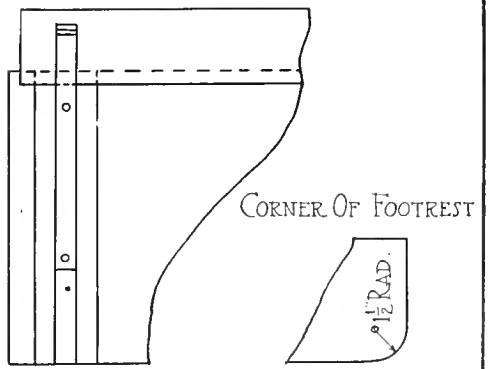


PLATE 46

SPRING SEAT.

Purpose. Because of hard usage and from being thrown around, the ordinary spring seat wears out before the wagon box. There remains a set of good springs and hooks and iron strips, leaving just the wood and rivets or bolts to be purchased. However, if desired all the hardware except the springs may be made in the shop.

Material. Pine and a set of hardware from an old spring seat.

One piece ¾″x8″x10′.
One piece ¾″x5″x3′.
One piece 1½″x1¾″x3′4″.
One piece 1″x1½″x24″.
One dozen $\frac{5}{16}$″ rivets or bolts 2″ long.
Four $\frac{5}{16}$″ rivets or bolts 1¼″ long.

Bill of Stock. Finished dimensions.

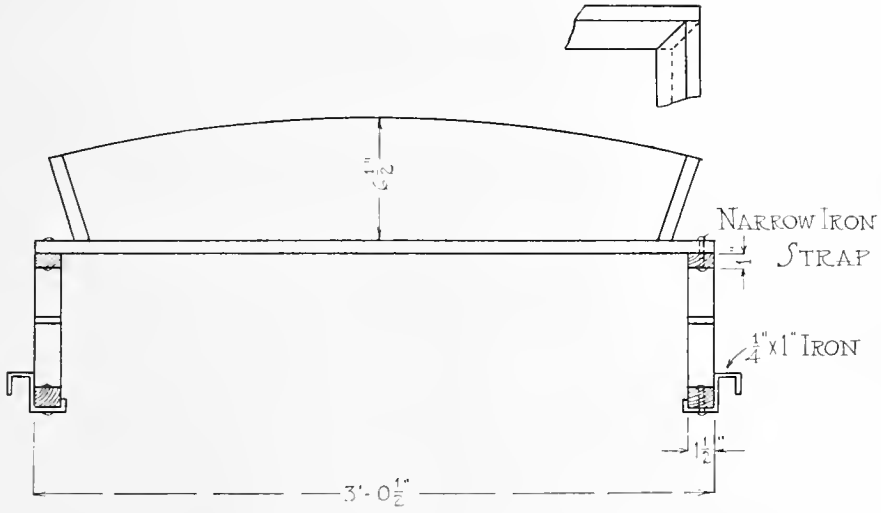
(1) One piece ¾″x16″x3′½″ for seat.
(2) One piece ¾″x6½″x2′11″ for back.
(3) Two pieces ¾″x4½″x17″ for ends.
(4) Two pieces 1½″x1¾″x19½″ for below springs.
(5) Two pieces 1″x1½″x11½″ for above springs.

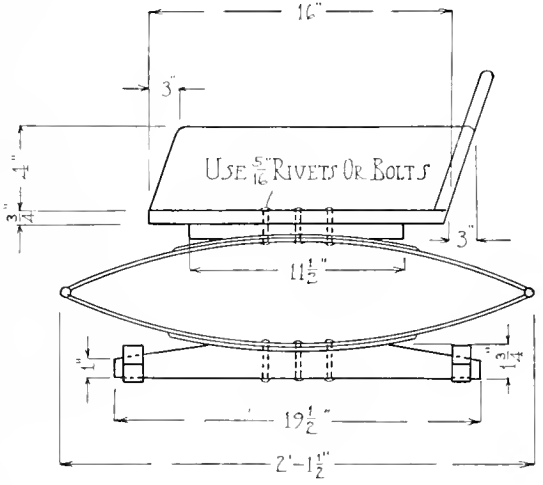
Tools. Saws, plane, drawknife, spokeshave, rule, pencil, try-square, brace, $\frac{5}{16}$″ bit, T-bevel and hammer.

Directions. Glue two 8″ boards together for bottom of seat, and work down to the dimensions given in No. 1 in bill of stock. Set the T-bevel at an angle of 1″ to 3″ (See illustration Plate II), and bevel one edge of No. 2 in bill of stock. Draw a freehand curve making the piece 6½″ high in the middle and curving down to 4½″ at each end. Work down to the line by using the drawknife, and round the edge with the spokeshave. Bevel one edge of each of the end pieces, using the given angle on the T-bevel, and plane to the line. Mark, saw and plane one end of side board to the angle of the T-bevel. Saw opposite end parallel to this. On the under side of the pieces directly under the seat, cut a curve with the spokeshave that will fit the curve of the springs, using a little more than two-thirds of the length of the piece in the curve. Mark the holes in this piece by placing it over the springs and marking with a lead pencil. Bore holes with a $\frac{5}{16}$″ bit. Use the same process on the pieces below the springs, using about 10″ in the curve and tapering the ends down to 1″. Mark and bore the holes for the spring, and also the hole at each end for the iron catches that fit over the wagon box.

Assembly. Nail the back piece to the seat and then nail on the end pieces. Bolt or rivet the catches at each end on the lower piece below the springs, then bolt, or rivet, onto the springs. Mark and bore the holes in the seat and bolt or rivet the springs to the seat.

SPRING SEAT
USE OLD SPRINGS





WAGON JACKS.

Purpose. A wagon jack is one of the most convenient articles that can be had about the farm. In greasing wagon wheels the jack is placed beneath the axle and the wagon is easily lifted by using the lever of the wagon jack. The wheel is then easily removed while the greasing, or any repair work is done. Thus a great deal of clumsy and heavy lifting and a great deal of dirt on the clothing is saved.

No. 1.

Material.

One piece 7/8″x3″x7′3″ oak or hard pine without knots.
One piece 1¾″x3″x16″.
One bolt or hard wood pin ½″x5″.
One piece strap iron 3/16″x¾″x17″.
One piece round iron ⅜″x3′10″.
One bolt ⅜″x2″.
Two bolts ⅜″x3″.

Bill of Stock. May be worked out from the drawing.

Tools. Saw, plane, rule, chisel, pencil, brace, ⅜″ bit, try-square, post drill and ½″ drill bit, forge, anvil, hammer, vise tongs, and monkey wrench.

Directions. Make the base piece to dimensions given in the drawing. In making the uprights, measure in 3″ from an end and make a notch ½″ deep to fit over the base. Bore seven ½″ holes in the other end 1½″ apart, lengthwise and alternating ¾″ from each edge. Place both pieces evenly in the vise and bore the holes in both at the same time so that the pin will work smothly. Do not bore entirely thru—only until point of bit appears, and then bore from the other side to make a smooth hole.

Taper one edge of the lever until it corresponds to measurements in drawing. Bore a ½″ hole in lever arm ¾″ from lower edge and 5½″ from end, also a ⅜″ hole in center of piece 24″ from end.

In the forge shop bend strap iron around the end of the lever as shown in drawing. Make an eye in each end of the ⅜″ round iron either by bending or by upsetting and then punching. Measure off 20½″ from the center of the eye and bend back at right angles. Measure over 3½″ and bend back at right angles.

Assembly. Put the two uprights over the base, place in vise, bore two ⅜″ holes, and insert the bolts. Bore some holes in the strap iron; countersink and put in screws. Fasten the ⅜″ iron catch to the lever. Slip the iron over the uprights, slide the lever between the uprights, and insert the pin. The lever may be raised or lowered to meet different heights of axles.

No. 2.

Material.

One piece 1¾″x4″x12″.
One piece 1⅝″x6″x2′2½″.
One piece 7/8″x4½″x20″.
Two pieces strap iron 3/16″x1″x3½″.
Two pieces strap iron 3/16″x1″x3″.
Two bolts ½″x3″; two ½″x3½″; one ½″x4″; one ½″x5″.
Glue.

Bill of Stock. Finished dimensions.

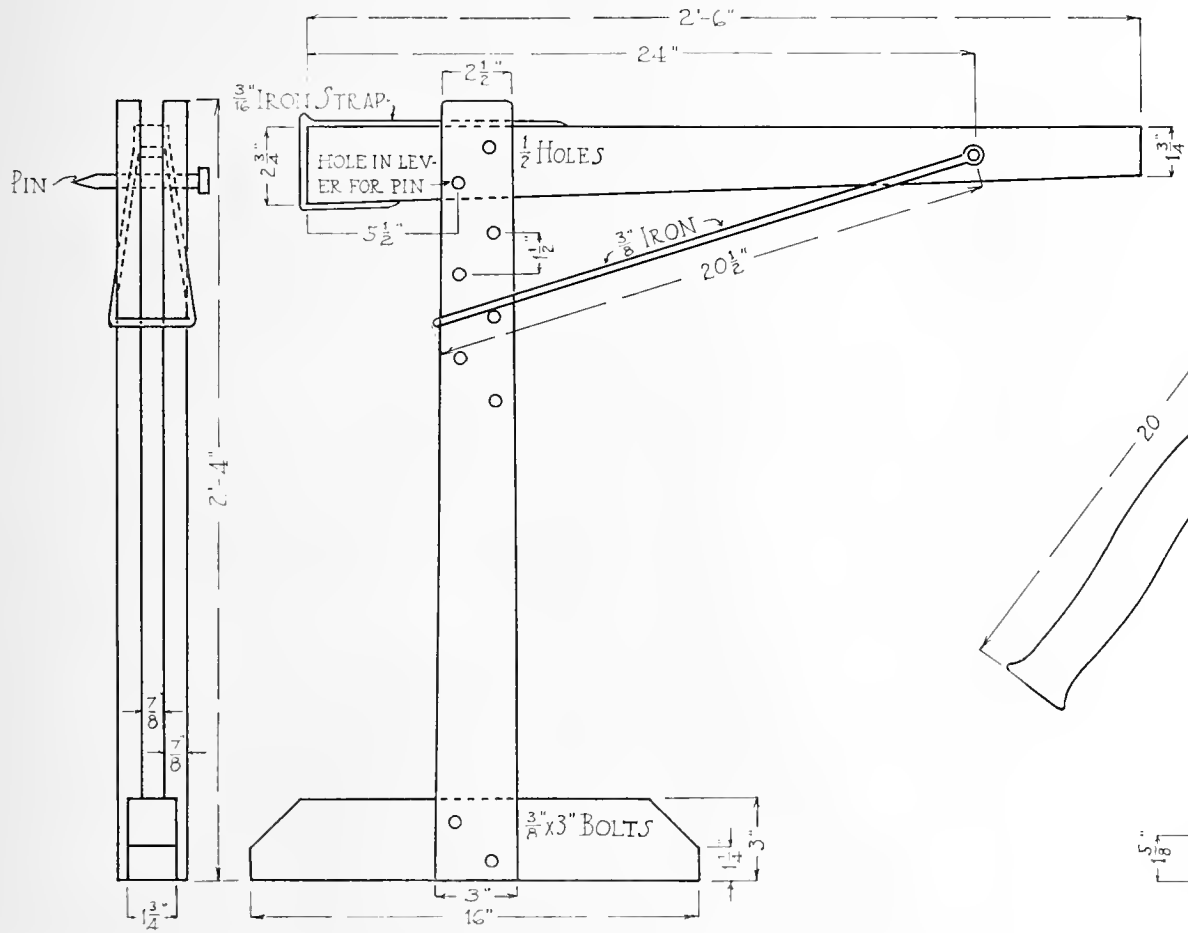
(1) One piece 1¾″x4″x12″ for base.
(2) One piece 1⅝″x6″x2′2⅛″ for uprights.
(3) One piece 7/8″″x4½″x20″ for handle.

Tools. Saws, planes, rule, chisel, ½″ and 1″ bits, knife, try-square, spokeshave, wood file, monkey wrench, post drill and ½″ drill bit.

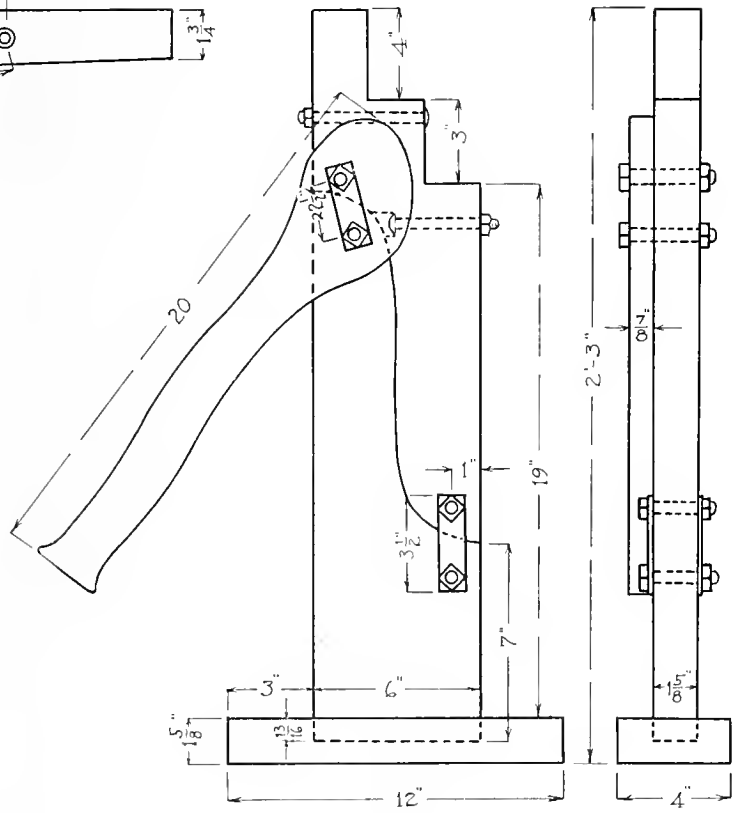
Directions. Lay off and chisel out the mortise in the base. This mortise is 1⅝″ wide, 6″ long and 13/16″ deep. On the upright piece two notches, or steps, are to be made. At the upper end lay off two lines parallel with the end, one down 4″ and the other 7″. Set the gage 2″ and gage

WAGON JACKS

No 1



No 2



between the lines, then at 4″ and gage from upper line to end for the upper notch. Saw to these lines. Lay out the curve on the piece beginning 7″ from the lower end and finishing about 7″ from the other end on the opposite side. Saw with a coping or turning saw.

Lay out the irregular curves for the handle and saw, or shave to line with spokeshave.

Bore two ½″ holes in upper end of the upright piece in about the positions shown in the drawing. These are to hold bolts which keep the wood from splitting. The lower hole should be started with the 1″ bit and finished with the ½″ bit. This allows the bolt to fit down into the wood without interfering with the surface. The holes in the strap iron pieces should be drilled with the post drill. The distance between centers in the 3½″ pieces is 2½″, and in the 3″ strap the distance between centers is 2″.

The centers for the holes in upright piece at lower end are 1″ from edge. The upper holes should be bored in about the position shown in the drawing.

Assembly. Glue the upright piece to the base, and put in some long finishing nails. Put in the upper bolts in the uprights before fastening on the lever. Then put on the lower straps.

SAND BOX.

Purpose. This box is made for the purpose of hauling heavy stuff such as sand, dirt, trash and stones, and it is needed on every farm. It is made with a loose bed so that the dirt and sand may be unloaded without shoveling, simply by turning the bottom boards up edgewise. Grain boxes are sometimes used for hauling these heavy loads, but they soon wear out, being too light.

Material. Rough sawed yellow pine or oak.

Two pieces 1¾″x12″x14′.
One piece 1¾″x12″x3′6″.
Ten pieces 1¾″x4″x12′.
One piece ⅞″x6″x8′.
A number of 8d. common nails.

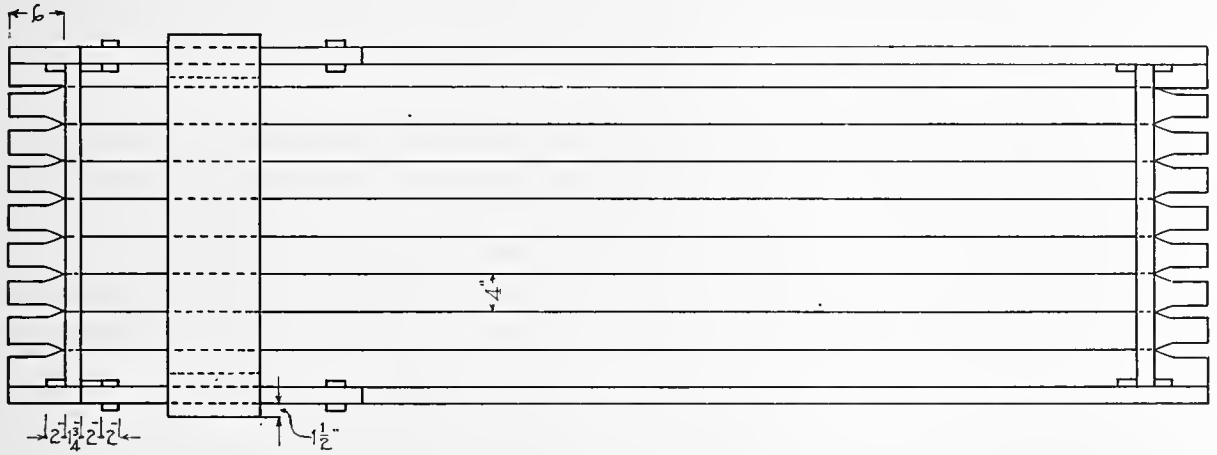
Bill of Stock. The size of the different pieces may be taken easily from the drawing.

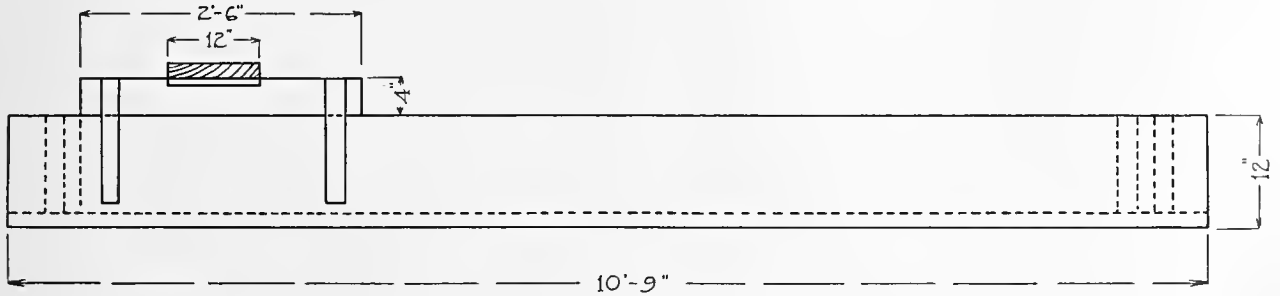
Tools. Saws, square, rule, pencil, drawknife and hammer.

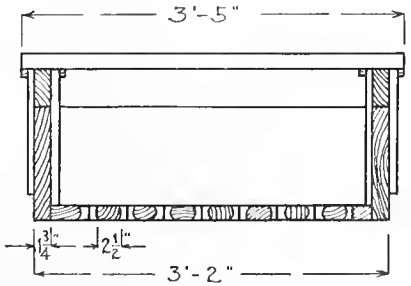
Directions. Saw the floor boards to length. Cut down the ends of each with a drawknife, leaving the handles about 2½″ wide and continuing the same size about 4″ back, as shown in the end and top views in the drawing. Then taper back to the end gate which is 6″ from the end. Round off the corners until they are elliptical so that the hands may not be injured while using the box.

Assembly. Nail the strips to hold the end gate to the side pieces. These are to hold the end gates as well as to keep the side pieces in place. Place the sides between the standards of the wagon and put in enough of the 2″ x 4″ pieces to make a fairly tight floor, sawing one piece at the side if necessary. Make the small extra side boards that elevate the seat and put in place. Put the seat board in place, mark the places for strips, and nail them on as shown in the detail. The extra side boards are not entirely necessary, but they make riding more comfortable.

SAND BOX







HOG COOP.

Purpose. This coop is a frame that fits over an ordinary wagon box. It is made principally for hauling hogs, altho sheep, calves, or cattle are easily carried in the same coop. Some men haul hogs in a tight box, but this is sometimes fatal to fat hogs in hot weather for they sometimes smother to death.

Material. Yellow pine.

Eleven pieces ¾″x4″x16′.
One piece ¾″x4″x12′.
One piece ¾″x8″x14′.
Four wagon box rods.
Four dozen $\frac{5}{16}$″x2½″ bolts.
A number of 6d. and 8d. common nails.

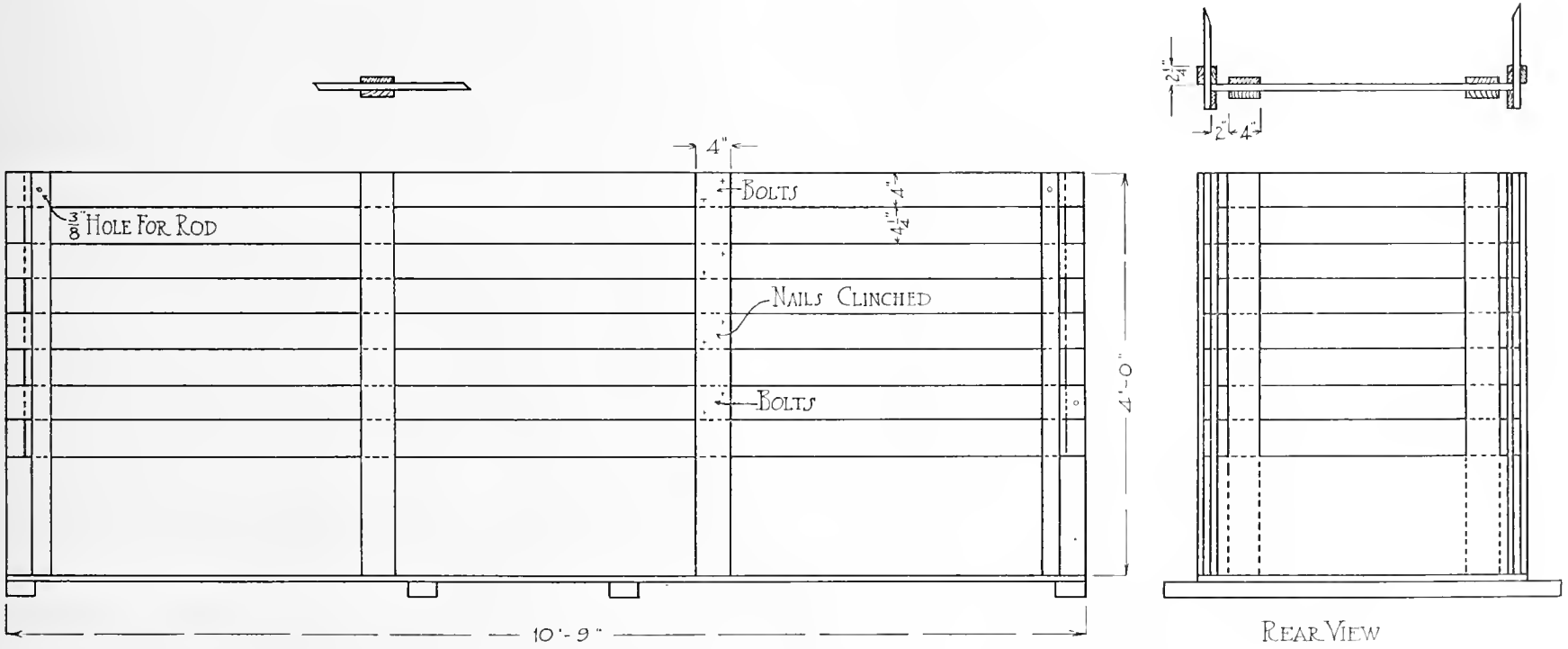
Bill of Stock. The dimensions of pieces may be easily found from the drawing.

Tools. Saws, plane, square, rule pencil, brace, $\frac{5}{16}$″ and $\frac{3}{8}$″ bits, monkey wrench and hammer.

Directions and Assembly. Notice that one 16′ board will make one piece each of side strip and end gate. The 8′ board makes the smaller strips for outside and inside corners. Accurate measurements should be taken from the wagon box for which you expect to make this coop. The strips on each side of the end gate of the coop must correspond to those of the wagon box. Lay on the floor of the shop six inside strips, the narrow short strips at the ends, and the long upright strips in the middle. Lay on these, at the upper end, a long side piece, placing the narrow strips flush with the ends, and allowing a $\frac{3}{4}$″ space for the end gate. Divide the other distances equally for the middle strips. Put on to these the four outside pieces in the places shown in the drawing. Drive a nail thru all these to hold them temporarily. Slide in another long strip leaving a $4\frac{1}{4}$″ space, and nail as before. Likewise put on the other two strips. In each of these joints bore a $\frac{5}{16}$″ hole, and put in a bolt, driving another nail to make a strong joint. Carefully clinch all nails. Make the other side in the same manner. The end gates are made in the same manner, but they are smaller and more easily handled. Lay down the two outside strips and place on these the cross strips, then the inside upright strips. Make sure that the ends are straight, then nail and bolt the joints as before. When you have completed the end gates and are ready to put the coop together, notice the holes for the rods in the side view of the drawing. The lower rod is put in the gate outside to keep the animal from pushing it out, while the top rod is put in on the inside to balance the pressure.

HOG COOP

TO FIT WAGON BOX IN PRECEDING DRAWING



HAY FRAME.

Purpose. The hay frame is one article that is nearly always made at home on the farm. There are many types of hay frames or hay racks: the flat rack for a low "handy wagon," the rack with bows at the back which curve up over the hind wheels, and the box rack used to a great extent in wheat growing countries. The box rack given here is selected from many styles of the box rack. Rough lumber can be used to good advantage in its construction.

Material.

(1) Two pieces 2″x10″x14′ red elm or pine.
(2) Three pieces 2″x6″x16′.
(3) Two pieces 2″x4″x14′.
(4) One piece 2″x4″x12′.
(5) Three pieces 2″x4″x8′.
(6) Three pieces ⅞″x12″x14′.
(7) Six pieces ⅞″x10″x14′.
(8) Four pieces ⅞″x6″x16′.
(9) Two pieces ⅞″x6″x12′.
(10) One piece ⅞″x6″x14′.
(11) Twenty-six bolts ⅜″x4¾″.
(12) Twelve bolts ⅜″x3″.
(13) Eight bolts ½″x4″.
(14) Sixteen bolts ½″x18″.
(15) Sixteen pieces strap iron ¼″x1¼″x4½″.
(16) A number of 8d., 10d. and 16d. common nails.

Bill of Stock. The bill may be made out by the pupil. In most cases the bill of stock nearly corresponds with the list of materials. In following the directions given below, and the drawing, the bill of stock may be made out as you proceed with the work.

Tools. Saws, planes, hammer, square, try-square, T-bevel, rule, pencil, gage, brace, ⅜″ and ½″ bits, post drill with ½″ drill and chisel.

Directions and Assembly. Taper the four cross arms as shown in the end view of the drawing. Begin to taper these cross arms 24″ in from each end, and finish ends to about 4″ wide. Saw out a notch at each end of the cross arm 1⅝″ x 1⅝″ to allow the two pieces made from the studding to fit flush with the end and top.

Lay on the floor the two 2″ x 6″ pieces fourteen feet apart, and lay the 2″ x 4″ pieces at correct places. Place on these the two pieces 2″ x 10″ x 14′ in the position shown in the top view of the drawing. These pieces are 3′ 2″ apart over the hind wheels and 2′ 8″ apart over the front wheels. Place on the four cross-arms at proper places. Mark and bore holes in the lower cross pieces. Drill the holes in the iron straps 3¼″ from center to center. The construction of these joints is shown in detail. There are eight of them and they require the most careful work of the whole problem. When these joints are all made, nail on the 1⅝″ x 1⅝″ pieces at the end of the cross-arms. Saw out and bolt on the front and back ladder pieces.

Bolt and nail on the corner uprights. Brace the ladder pieces by a board 2″ x 6″ cut to the right length. Notch these out to fit, and nail on. Nail the crosspieces onto both ladders, putting one bolt in each end.

Fit in the floor of the rack, and nail. Likewise nail the covering onto the cross-arms.

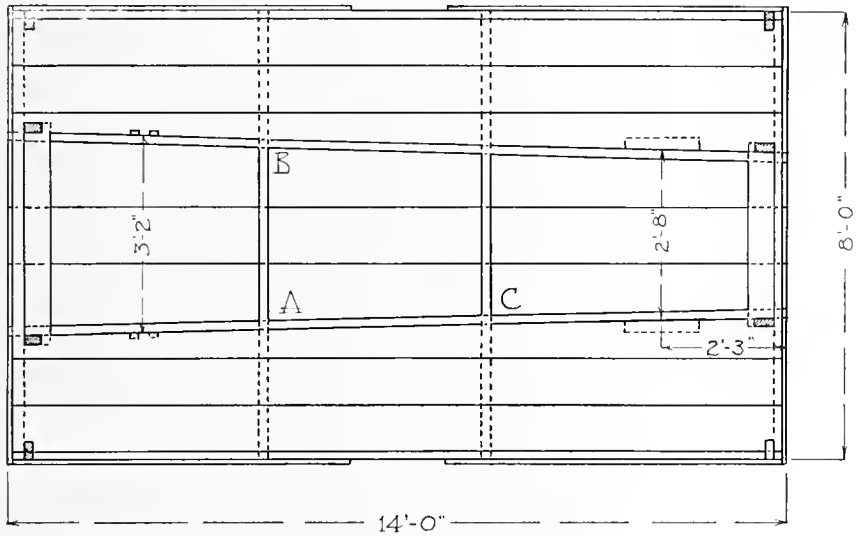
Put on the side slanting pieces, using one bolt in each end and finishing with nails. The last piece, No. 17, goes at the top of the ladder.

Put on the cleats at D and E. The cleats at D prevent the rack from sliding forward and backward, and those at E are to prevent the front end slipping from side to side.

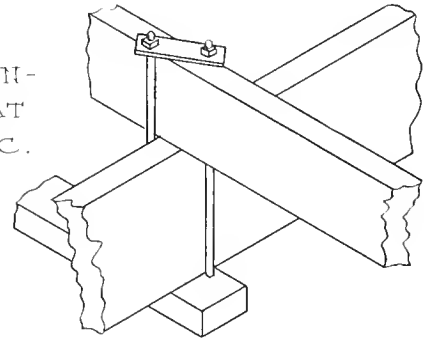
The floor of the rack is narrow at the front end to allow the wagon being turned in a much smaller space.

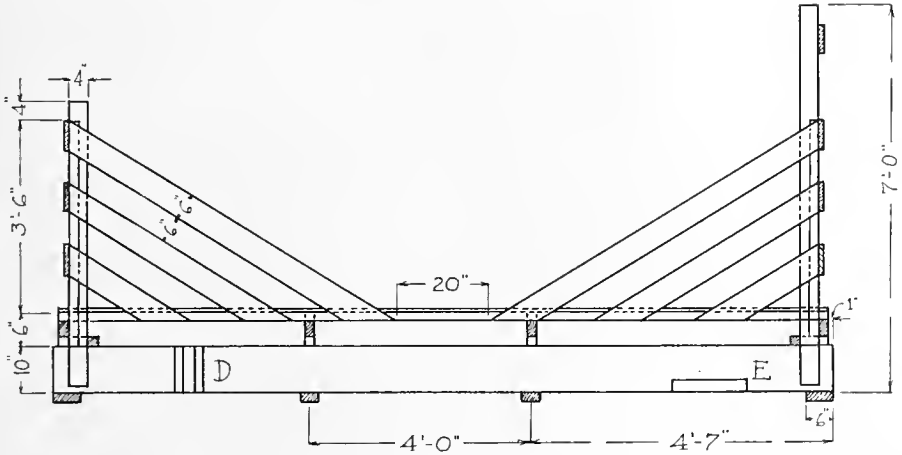
Hardware for the eight joints shown in detail may be bought, but they are often more troublesome than the home made kind shown in the detail. This kind of joint is often made by running a bolt down thru these three pieces shown in detail, but this is poor construction, since each piece is weakened to a great extent.

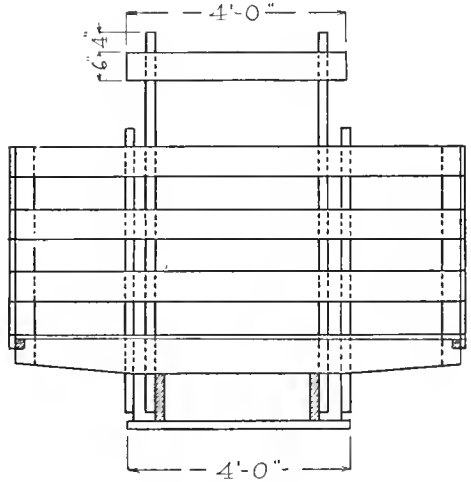
HAY FRAME



DETAIL OF CONSTRUCTION AT A-B-C, ETC.







PIGEON HOUSE.

Purpose. This house is designed to serve a colony of pigeons, there being fourteen separate nesting boxes. It will appeal to the boy or man interested in pigeons, and the making of this box will add interest to the pigeons themselves, as well as to give training in shopwork and construction.

The house should be placed on a platform well up out of the reach of cats and other animals.

Material.

(1) One piece ⅞″x12″x10′ for front pieces.
(2) One piece ⅞″x12″x12′ for side pieces.
(3) One piece ⅞″x12″x12′ for middle and upper floors.
(4) One piece ⅞″x12″x10′ for lower floor and lower crosswise partitions.
(5) One piece ⅞″x12″x14′ for all middle partitions, also lower lengthwise and upper crosswise partitions and supports for perches.
(6) One piece ½″x12″x16′ for roof boards and finishing casing for roof.
(7) A number of 8d. common nails, shingle nails, and finishing nails.
(8) One-half bunch of 14″ shingles.

Bill of Stock. You will notice in the list of materials that you are told into what each piece is to be made. By following the directions and drawing carefully no trouble will be experienced in making out the sizes of each piece.

Caution. Most of this house is made from 12″ lumber. If for any reason the lumber should be less than 12″ shorten the length and width of the house enough to make it correspond to the widths used.

Tools. Saws, planes, hammer, square, try-square, T-bevel, gage, brace, ½″ bit, extension bit, rule, pencil, chisel, key-hole saw.

Directions. Saw four front and back pieces from 10″ board mentioned in No. 1 in list of materials. In making roof slant of 45° angle, make one sawing do for both pieces. Lay pieces forming fronts on to bench in position. Lay out and make openings, both ends and fronts being alike.

To make side pieces, lay off on piece No. 2 in list of material, 2′ and mark across. Set bevel to edges of this board and draw lines on both edges. This makes entire length of this board 2′⅞″. Saw carefully and you can make one sawing bevel two pieces. Cut six of these side pieces.

For floors and partitions, except top partition under the roof, saw up numbers Nos. 3 to 8 in list of material to correct dimensions.

To make top partition cut the piece 12$\frac{1}{16}$″ long, draw diagonal and saw, making two triangular pieces. Saw off one point on each triangle, leaving the board 10$\frac{11}{16}$″ wide. These two placed together form the roof partition.

Saw out roof boards, and bevel two pieces at 45° angle as shown at A in drawing.

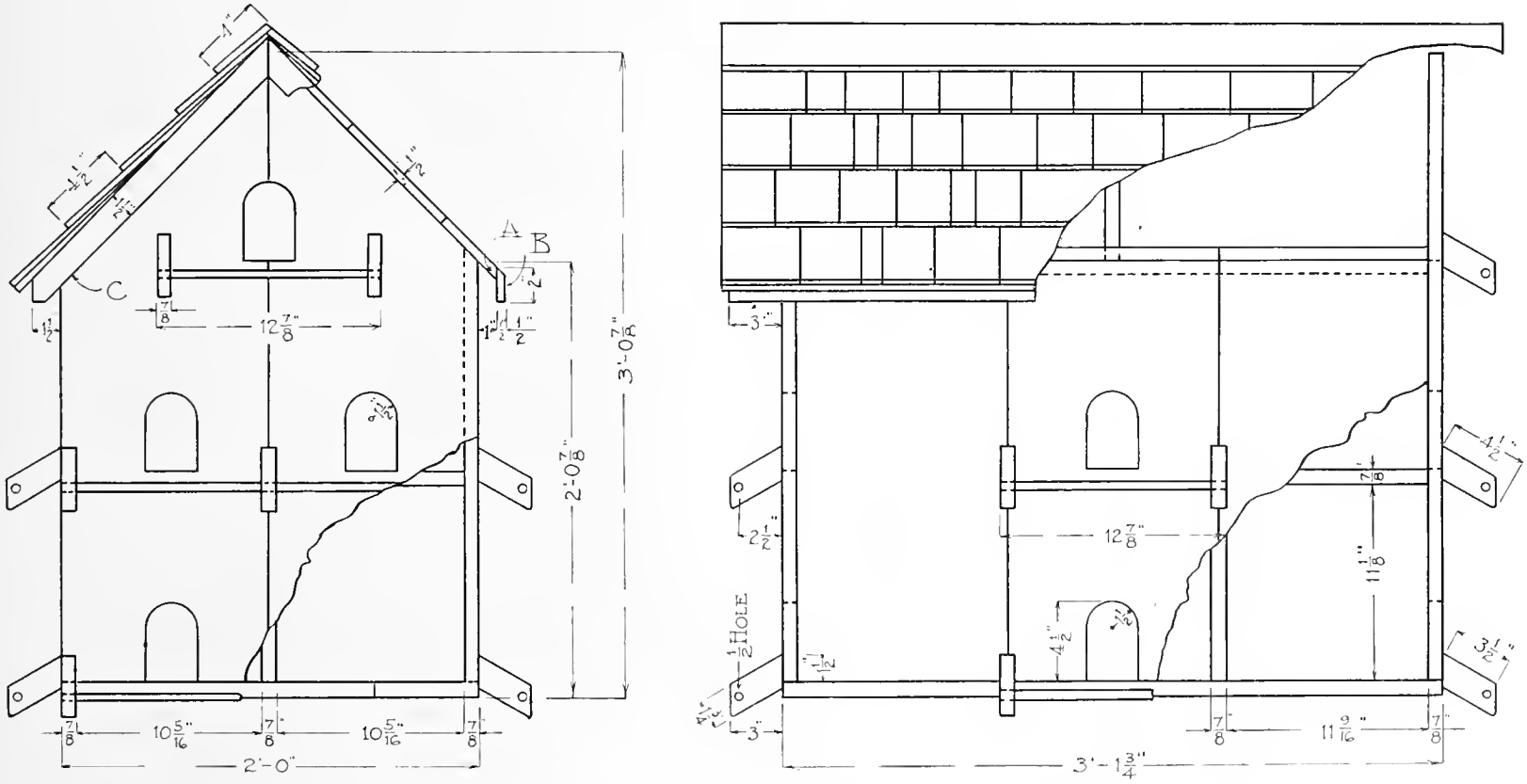
Saw two pieces for roof casings to dimensions shown at B in drawing, and bevel one edge at a 45° angle.

Set T-bevel at 60°. Lay off and cut twenty-four pieces for supports for perches. Make perches from left over pieces or ½″ dowels.

Assembly. The floors in each case should have the 12″ board in the middle and the 6″ boards on each side so as to break joints with the front and back pieces.

Nail middle piece of first floor and lengthwise partition together at proper places. Nail on separately the four pieces forming the front and back. Put in rest of first floor. Raise to upright position, and put in lower crosswise partitions. Nail on second floor. Put on six side pieces, nailing first to middle floor. Turn the house over and nail to first floor. Place and nail in all second story partitions, then third floor and roof partition.

PIGEON HOUSE



Nail on the roof boards, putting the two beveled boards on first. Miter piece B at each end, taking exact measurements from roof boards, and nail.

Work out pieces marked C in drawing and nail on to roof boards, the lower end being mitered to fit piece B. Saw off extra portion below piece B, and miter upper end at 45° angle.

Put on shingles, allowing them to extend over the ends ½″ and over eaves 1″.

Put on ridge boards, first beveling them to correspond to slope of upper row of shingles.

Fit all perches and supports together, and put in small finishing nail thru the ends of each to hold the dowel in place.

Nail the supports to the sides of the house, the upper edge of the support being in each case 1½″ above the lower edge of the opening in the house.

Give two good coats of paint.

BRUSH AND CURRY-COMB CABINET FOR BARN.

Purpose. This is a convenient box to keep about the barn for the curry-combs, brushes, medicines and other articles usually stuck in odd, out-of-the-way places. Articles always kept in one place can be found quickly.

Material. Yellow pine or white pine.

One piece ¾″x8″x11′.
One piece ½″x8″x4′10″.
One pair 1½″ butt hinges.
One screen hook.
A number of 6d. and 8d. finishing nails, also some glue.

Bill of Stock. In making out the bill of stock all pieces should be made to dimensions shown in drawing, except the two side pieces for the panel door, which should be made 2″ longer as is usual in making panel doors.

Tools. Saws, plane and plow, brace, ⅜″ bit, try-square, rule, pencil, gage and hammer.

Directions. In making this door follow the rules usually given for making panels. Leave the rought material somewhat wider than the dimensions called for in the drawing; plane one joint edge on each of the four pieces; lay out and make the mortises and tenons; plow out the groove for the panel; fit the panel, and glue only the joints, leaving the panel free to shrink and swell. After the glue has set, saw off extra lengths, and plane down to exact dimensions.

Assembly. Nail the sides to the top and bottom. Nail in the shelf; then nail on the back. Lastly put on the front casing and fit and hinge the door.

SCALES AND A CONVENIENT CASE FOR WEIGHING AND SAMPLING MILK.

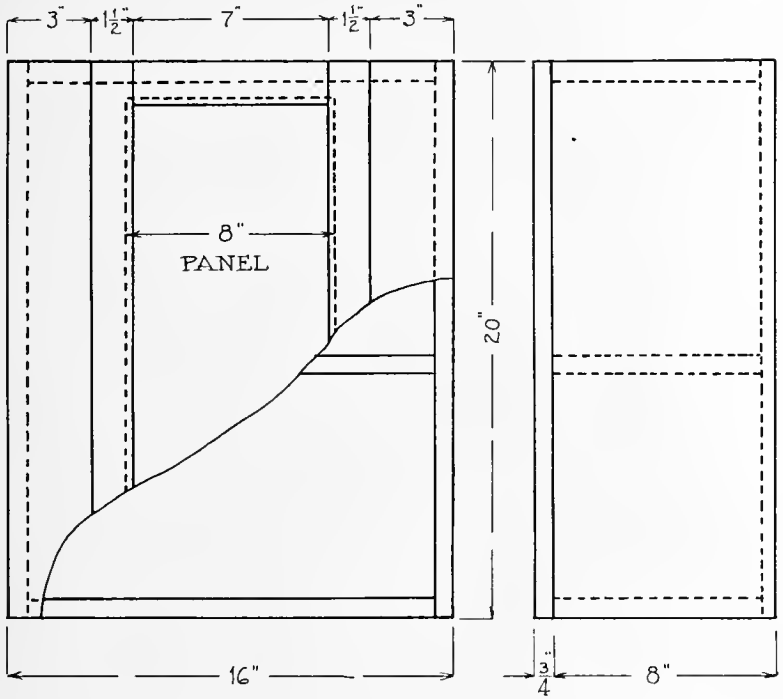
Purpose. The case shown in the drawing is one to be used by the farmer running a dairy. The shelves afford a place for keeping bottles and material for sampling milk. The scales are for the purpose of weighing the milk from an individual cow. The door that is let down forms a desk on which to write when jotting down any data. The scales hang on an iron arm which can be swung around in front or a little to one side of the case.

When not in use the arm and scales are swung around into the box, and the door is closed until used again. The box should be nailed to the side of the dairy house at the most convenient height for the man who is to use it.

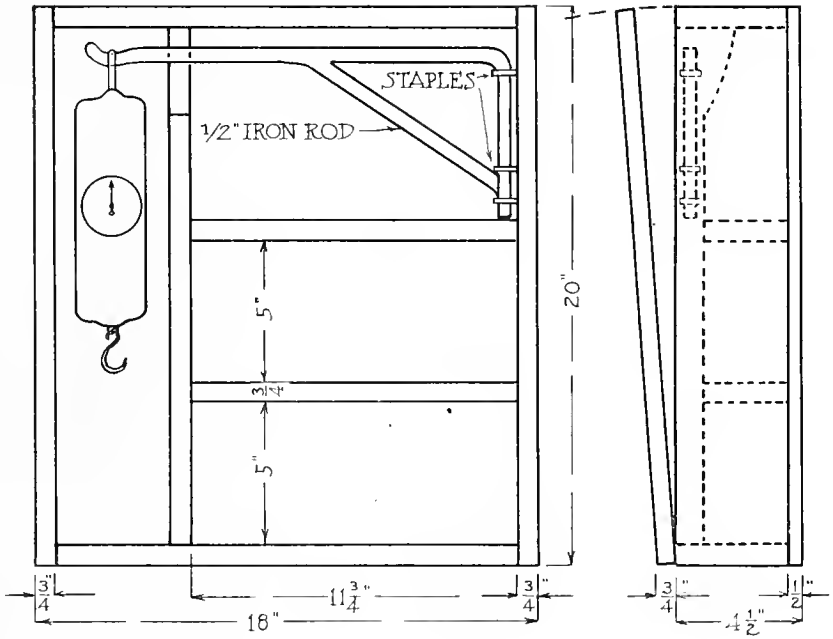
Material. Yellow pine or basswood.

One piece ¾″x8″x10′.
One pair 2″ butt hinges.
Three staples.
One piece Norway iron ½″ dia., and 2′6″ long.
One pair scales.
A number of 8d. common nails and 8d. finishing nails.

BRUSH AND CURRY-COMB CABINET FOR BARN



SCALES AND A CONVENIENT CASE FOR WEIGHING AND SAMPLING MILK



Bill of Stock. Make all pieces to dimensions shown in the drawing.

Tools. Saws, plane, try-square, rule, pencil, hammer, and forging tools.

Directions. Saw and plane to dimensions all pieces shown in the drawing. This will finish all but the upright partition piece. This has the upper end cut away so as to allow the rod supporting the scales to swing freely. The greatest work will be in making the iron rod and brace in the forge shop. The door is made of two pieces glued together, or two strips may be screwed crosswise on the outside.

Assembly. Nail the top and bottom to the sides, put in the partition and shelves and lastly the back. Put in the iron rod and brace with the staples, in the position shown in the drawing. Fasten the door with hinges at the bottom, and a small hook and screw-eye at the top.

BEE HIVES.

Bee raising is becoming more and more popular, not only for the interest and pleasure which the bees afford, but for the profit derived from them. Many farm homes are amply supplied with honey to the extent that it practically takes the place of sugar for all cooking purposes. The village and small town afford most excellent places for raising bees, and it is altogether possible to keep them in cities.

The accompanying drawing is for a very complete and well equipped hive, such as a man would wish to use in extensive bee raising. The hive stand is used when the hives are kept on the ground. The front slanting board affords a landing place for the bees, as they fly home laden with honey. The feeding board given in detail is a platform where bees may feed if the left-over honey is exhausted and there is no feed to tide the bees over until summer.

The hive proper is for the breeding comb, and the place where the bees store food for themselves during the winter, altho this also is taken out if so desired. The supers which are placed above the hive are for additional honey after the hive proper has been filled. It is in these supers that the comb honey is produced for market.

Material.

One piece 7/8"x10"x12' pine.
One piece 7/8"x6"x14'.
One piece 7/8"x12"x14".
One piece 5/8"x8"x17".
One piece 3/8"x10"x9'.
One piece 1/4"x8"x18".
One piece galvanized iron 21 3/4"x2'3 3/4" for metal top cover.
A number of staples to go in at D in foundation comb frames.
A small quantity of tin strips 1/4" wide to use on comb frames and at C in drawing.
A number of different sizes of nails and brads.

Tools. Saws, planes, chisel, knife, rule, pencil, try-square, tin shears, gage, plow and hammer.

Bill of Stock. Finished dimensions.

HIVE.

Two pieces 7/8"x9 1/2"x20" for sides.
Two pieces 7/8"x9 1/2"x13 1/2" for front and back.
Two pieces 1/2"x3/4"x4 1/2" for adjusts for opening.
Two pieces 1"x1 1/4"x5" for handles.

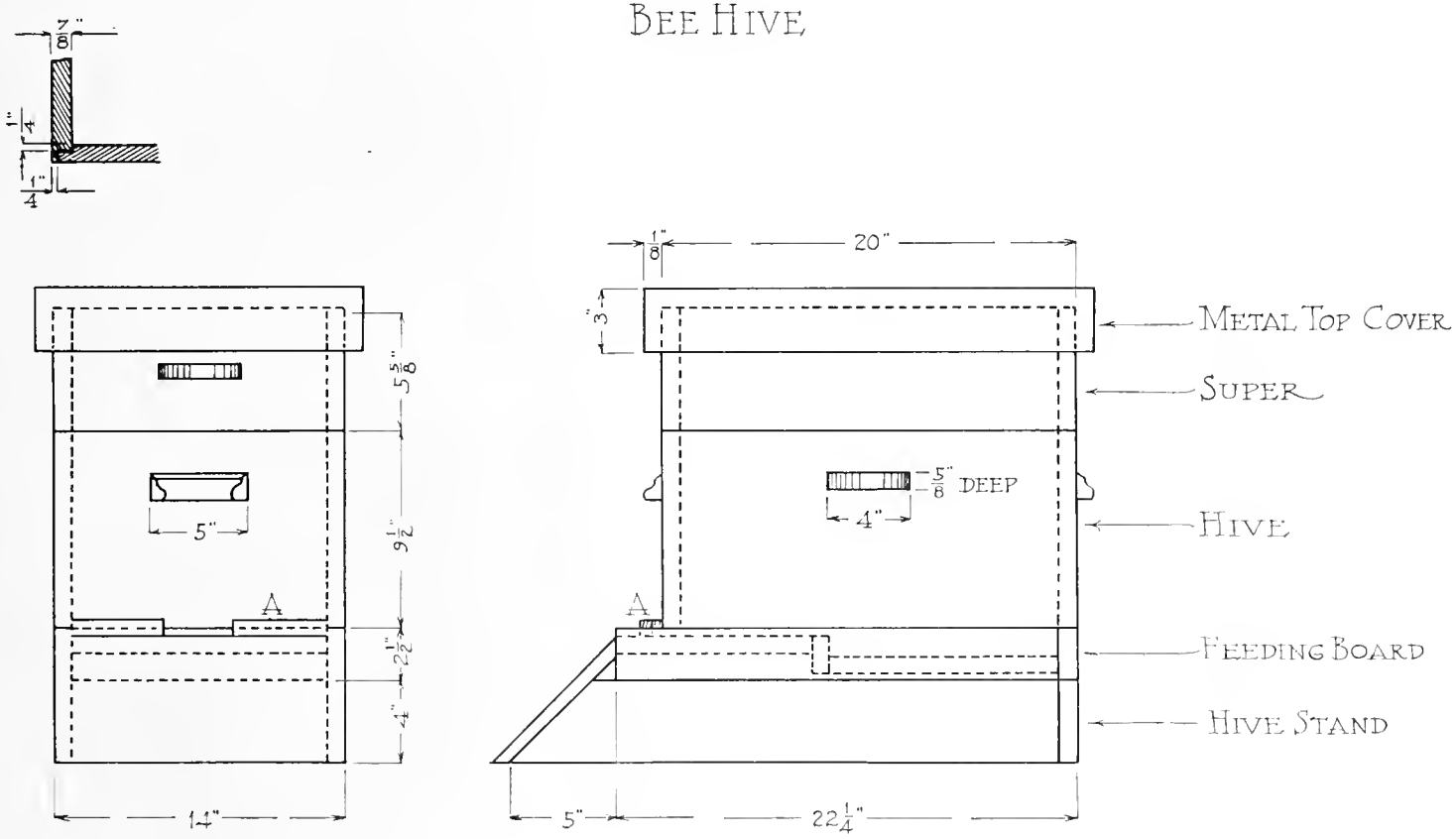
SUPER.

Two pieces 7/8"x5 5/8"x20" for sides.
Two pieces 7/8"x5 5/8"x13 1/2" for front and back.
Two pieces 1/2"x4"x12 1/4" for support for sections.

TOP COVER.

One piece 7/8"x14"x20" for top.
Two pieces 7/8"x3"x21 3/4" for sides.
Two pieces 7/8"x3"x14 1/2" for front and back.

BEE HIVE


7/8"
1"/4
1"/4
5 5/8"
9 1/2"
2 1/2"
4"
5"
A
14"
1/8"
20"
3"
METAL TOP COVER
SUPER
5/8" DEEP
4"
HIVE
A
FEEDING BOARD
HIVE STAND
5"
22 1/4"

FEEDING BOARD.

(1) Two pieces 7/8"x2½"x21⅜" for sides.
(2) One piece 7/8"x2½"x14" for back.
(3) One piece 7/8"x9½"x12¼" for front platform.
(4) One piece 7/8"x11⅞"x12¼" for back platform.
(5) One piece 7/8"x1⅜"x12" for division.
(6) Nine pieces ⅜"x¾"x11¼" for partitions.

HIVE STAND.

(1) Two pieces 7/8"x4"x2'2⅜" for sides.
(2) One piece 7/8"x4"x14" for back.
(3) One piece 7/8"x8½"x14" for front.

COMB FRAMES.

(1) Eight pieces ⅜"x1 1/16"x18¾" for upper part of frame.
(2) Sixteen pieces ⅜"x1 1/16"x9" for ends.
(3) Eight pieces ¼"x¾"x17½" for lower part of frame.
(4) Eight pieces 5/8"x¾"x16¾" for supports for foundation comb.

SUPPORTS FOR SECTIONS IN SUPER.

Seven pieces ⅜"x1¼"x16¼" for lower supports.
Fourteen pieces ⅜"x1¼"x5⅜" for uprights.

PARTITIONS BETWEEN SECTIONS IN SUPER.

Twenty-four pieces 1/16"x7/8"x16".
Twelve pieces ⅜"x5/8"x5".
Thirty-six pieces 1/16"x⅜"x4½".

Directions for Making Hive. Plow out the groove on the end pieces at the top ⅜" wide and ¾" deep for the projections on the upper ends of the foundation comb frame to rest on. Make the joints on the ends as shown in the detail on the first drawing. Nail the joints together carefully, making them insect proof to protect the bees. Put on the handles as shown in the drawing.

Super. The joints for the super are the same as for the hive and they are made in the same way.

Top. Make the top loose enough so that it will fit down loosely over the super. To do this leave the dimensions of the 14" x 20" board a little full. After the top has been nailed together bend and put on the metal top cover. A brick or some weight is usually put on the top to hold the hive and supers together in case of a high wind.

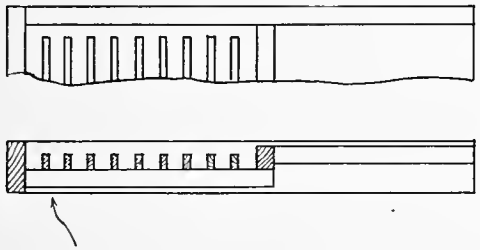
Feeding Board. Cut all pieces to dimensions given in the bill of stock. Notice the construction of the feeding board in the detail sheet. Nail piece No. 5 to piece No. 4 first, then No. 3 to No. 4. Nail on the sides and end, and lastly the small cleats.

Hive Stand. This may be made of a poorer grade of lumber than the hive and super. Measure down 4" on one edge of piece marked No. 1 in bill of stock, and draw line from opposite corner. Saw to the line. Nail on the back piece. Bevel both edges of No. 3 so that the upper end will fit up close to the feeding board and the bottom will be straight with the lower edge of the stand.

Comb Frame. Cut all pieces to dimensions given in the bill of stock. The detail of the drawing will show the kinds of joints to be made on pieces Nos. 1 and 2 in bill of stock. These pieces should have a little glue placed in the joints as well as a few small brads. Piece No. 4 in the bill of stock is the one most likely to be misunderstood. A cross section is shown and called B in the detail sheet. The small 1/16" groove is made with a very fine circular saw, set to saw ⅛" deep. The 1/16" groove holds the foundation comb. Wedge a small strip of wood into the ⅛" groove, thus holding the foundation comb firmly. The strip of tin put over the joint in each case is to add strength and to keep the bees from gluing the frame next to it together. The staple marked D in the detail sheet is for the same purpose as above, namely to keep the frame out away from the edge of the box. Also the piece of tin marked C is to raise up the frame to keep it from being glued down by the bees. This piece of tin runs the full width of the box.

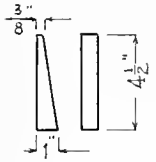
Supports for Sections in Super. These are easily and simply made. They consist of two end pieces and a bottom

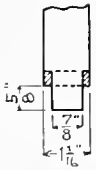
DETAILS OF BEE HIVE.



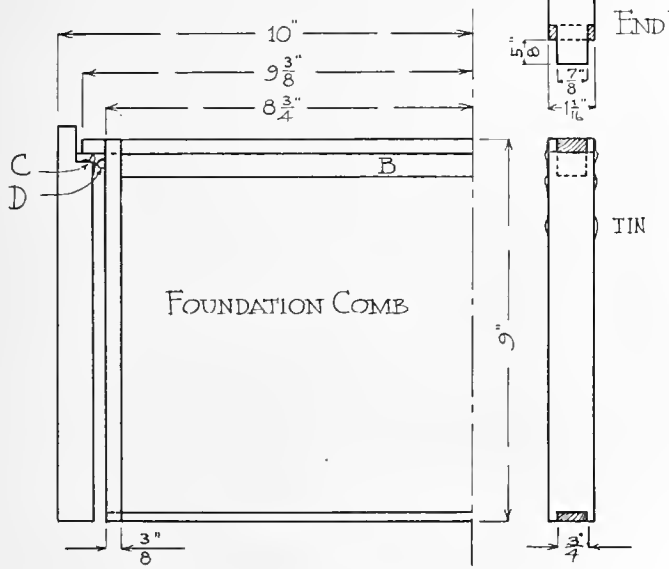
CROSS SECTION THRU FEEDING BOARD

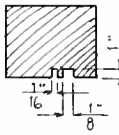
A
MAKE 2





END VIEW OF COMB FRAME

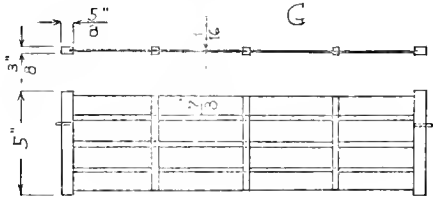


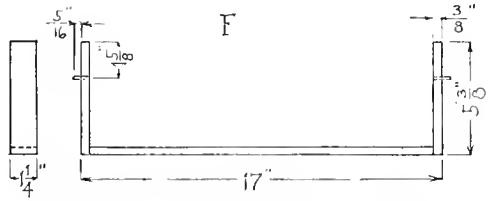


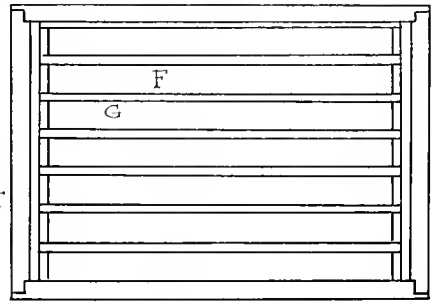
CROSS SECTION THRU B
SHOWING HOW TO INSERT
FOUNDATION COMB

C D
TIN
STAPLE

DETAILS OF SUPER







piece nailed together, and small steel pins. These pins may be made from wire nails, the heads being filed off.

Partitions between the Sections in Super. These partitions call for very thin pieces of wood and must be handled carefully. None of the pieces need to be planed or smoothed down. It is not absolutely necessary that these be placed between the sections but it leads the bees to fill the boxes more evenly. A small toothed circular saw is almost necessary in making these pieces. Saw out all pieces to dimensions given in bill of stock. Make the joints on the end pieces by running the circular saw set about $\frac{1}{8}''$ deep down thru the middle of the piece. Nail them together with very small brads and use a brad for the pivot, cutting it off if too long.

BEE HIVE FOR THE AMATEUR.

Ask your grocer for a cracker box, or some box of about the same size. In the bottom of one end of the box cut a slot $\frac{1}{4}''$ deep and 4″ long. Nail on two small cleats lengthwise about $1\frac{1}{2}''$ up from the bottom, and to these nail four or five crosspieces. This platform is a precautionary measure to prevent the comb from breaking and falling down when the box is removed from the tree in the fall. Buy a piece of foundation comb 8″ x 16″ and cut into strips 2″ x 16″. Nail in a small cleat across each end about $\frac{1}{2}''$ down, or the width of the boards you are to use for the first top. Lay in one of these strips of wood, resting it on the cleats. Now place next to this a strip of foundation comb, bending it over the edge of the wood a little. Melt the turned over edge of the foundation comb just enough to make it stick to the piece of wood. Finish out the top, alternating the strips of wood and the foundation comb. The last strip of wood should fit tight, being wedged down into place. This first top should be flush with the top of the box. Now fasten on the regular top that came with the box, or one similar to it. Nail a 2″ landing board below the opening in front.

Screw on at the back a piece $\frac{3}{4}''$ x 2″ x 24″ allowing it to stick up at least a foot over the back. This is to nail onto the tree when the hive is set out to catch wild bees.

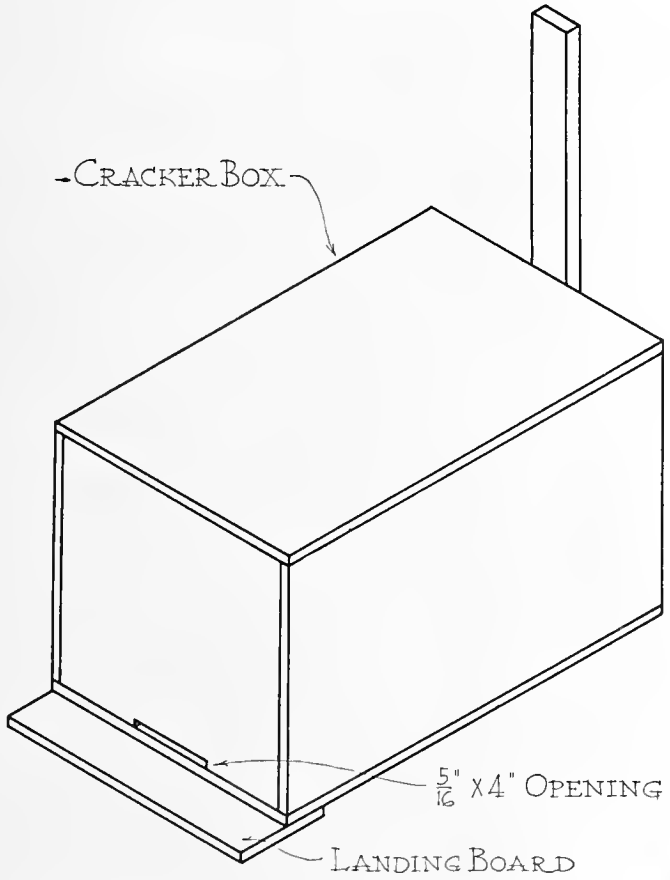
Select a tree with a branch coming out at a right angle as nearly as possible. Nail the strip of wood at the back to the tree trunk with a 16d. nail, leaving the head of the nail free so it can be easily drawn with a claw hammer. Put up these boxes early in the spring before the bees begin to swarm. The wild bees may be caught in the trees near the house or barns, in the woods or fields, or by the roadside. They may then be brought to the house if it is desired, or they may be left wherever they are caught until the honey season is over. In moving the swarm it is best to go after the bees are quiet for the evening, and close the slot opening to keep them all inside. After setting the box in its new place the slot may be opened and the bees will begin work with the new day. A long shelf nailed to the barn, or in any suitable place, furnishes an ideal place to keep several hives.

This simpler bee hive is one of the best problems that can be used for boys. They take a very high dgree of interest in its construction, and it gives them a very profitable summer interest. Of seven hives put out in this manner, the author secured six good swarms of bees in one season. This was in Southern Minneota.

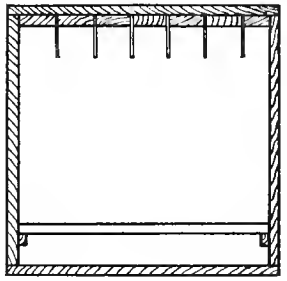
Mother Goose was a very modest bird when she said:

"A swarm of bees in May
Is worth a load of hay.
A swarm of bees in June
Is worth a silver spoon."

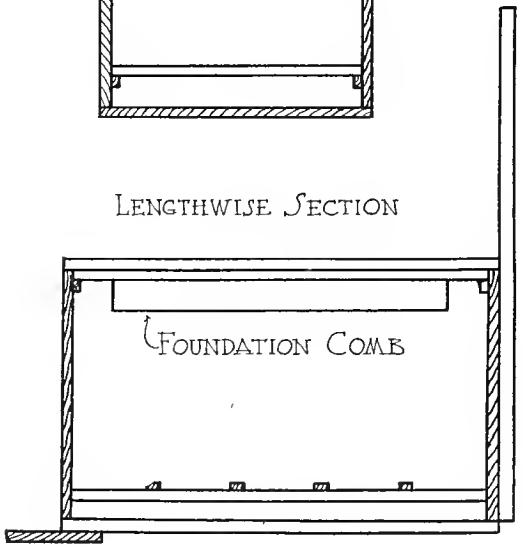
BEE HIVE FOR THE AMATEUR



CROSS SECTION



LENGTHWISE SECTION



CONCRETE MIXING BOX.

Purpose. The use of concrete is becoming almost universal. Concrete is easily mixed and it does not take an expert tradesman to do a great many simple kinds of work. Many farmers make their own walks, cisterns, vegetable cellars, fence posts and other things.

On the drawing are shown a small mixing box and a form for a small concrete post.

Material. Yellow pine.

One piece 7/8″x12″x16′.
One piece 7/8″x8″x12′.
One piece 7/8″x3″x9′.
One piece 1¾″x8″x6′.
Four laths or thin strips.
A number of 6d. and 8d. common nails.

Bill of Stock. Finished dimensions.

(1) Three pieces 7/8″x12″x5′4″ for bottom.
(2) Two pieces 7/8″x8″x5′8½″ for sides.
(3) Two pieces 1¾″x8″x3′ for ends.
(4) Three pieces 7/8″x3″x3′ for cross-braces.
(5) Four laths 2′3″.

Tools. Saws, plane, square, T-bevel, rule, pencil, gage, chisel and hammer.

Directions. Saw to dimensions all pieces mentioned in the bill of stock. Set the T-bevel to an angle of 3″ to 6″. (See illustration Plate II.) Plane to this angle one edge of each of the end pieces, No. 3 in bill of stock. Set gage to 7/8″ and gage across each end, gaging from the widest face, as this will be to the inside of the mixing box. Measure in on the inside face 7/8″, draw a line, and saw down to the gage line. Chisel out the material for the joint. This joint shows plainly in the top view of the drawing. Shape the side pieces, No. 2 in bill of stock, and measure up 6″ from one edge on the end. Set the T-bevel to this, draw the lines, and saw. Saw off the upper corner perpendicular to the edge just made at the 6″ point mentioned above.

Assembly. Lay the three bottom cross-braces on the floor and nail to these the floor of the mixing board. Nail the side and end pieces together, and then nail this frame to the floor. Nail the laths to the bottom over the cracks between the boards.

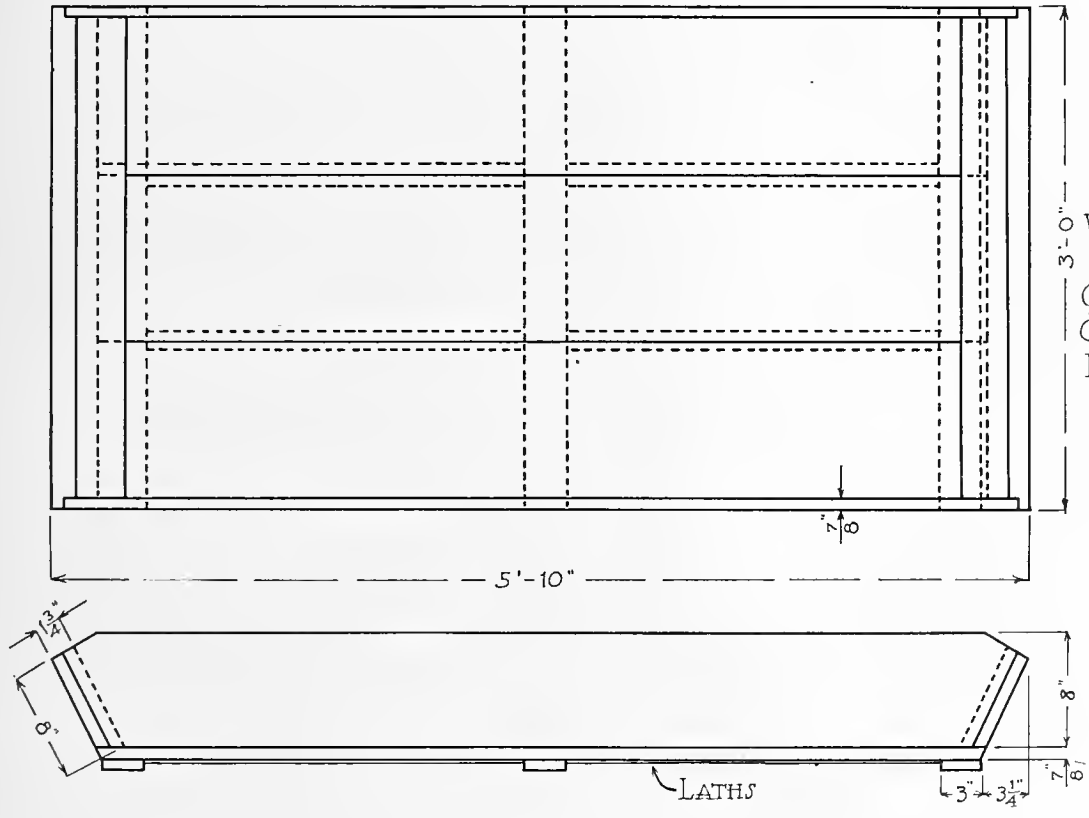
FORM FOR CONCRETE POST.

Material.

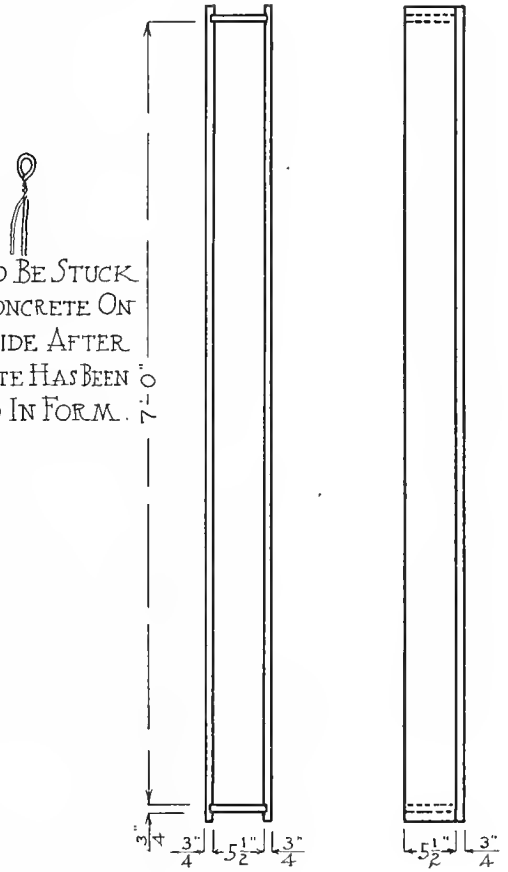
One piece ¾″x8″x8′.
One piece ¾″x12″x8′.
A number of 8d. common nails and several feet of wire.

The construction of this form is so simple that the entire line of procedure is left to the student. After filling in the concrete, stick the wires into position, the loop end being embedded in the concrete. The two loose ends are for fastening the wire as it is stretched into place.

CONCRETE MIXING BOX



FORM FOR CONCRETE POST



CONCRETE FORM FOR SILO FOUNDATION.

Purpose. This concrete form for a silo foundation was designed and built in the Manual Training Department at Spring Valley, Minn., and was used by the agricultural teacher in his work of helping the farmers build their silos. Each farmer paid a small fee for the rental of this form to offset the cost of construction. A well built form can be used for as many as twenty or two dozen silo foundations. The ordinary carpenter is unacquainted with this kind of construction, since it is not usually in his line of work. It is a most practical and useful article for a shop problem in any agricultural school.

The diameters of silos vary greatly, but for the ordinary farmer with a small dairy or stock herd, the fourteen foot silo is coming to be recognized as the standard size, the height varying to suit the farmer. Brick, tile, and stave silos are built with the concrete base from twenty to twenty-four inches high and twelve inches thick.

In building this form, the best grade of lumber should be used, especially for the boards that are to be bent. The lumber should be as free from knots as possible. Selected white pine is especially adaptable for the boards to be bent. The remainder of the form should be of good common lumber.

Material.

Six pieces $\frac{7}{8}$″x10″x14′.
Eight pieces $\frac{7}{8}$″x10″x12′.
Two pieces 2″x6″x14′.
Three pieces $1\frac{1}{4}$″x6″x14′.
Three pieces $\frac{7}{8}$″x6″x14′.
Nine pieces 2″x4″x14′.
Three pieces $\frac{7}{8}$″x4″x12′.
One piece $\frac{7}{8}$″x10″x10′.
One piece $\frac{7}{8}$″x10″x16′ (to make pieces $\frac{7}{8}$″x10″x12″.)
An assortment of nails.

Bill of Stock. The material will be cut to correct dimensions as the work proceeds.

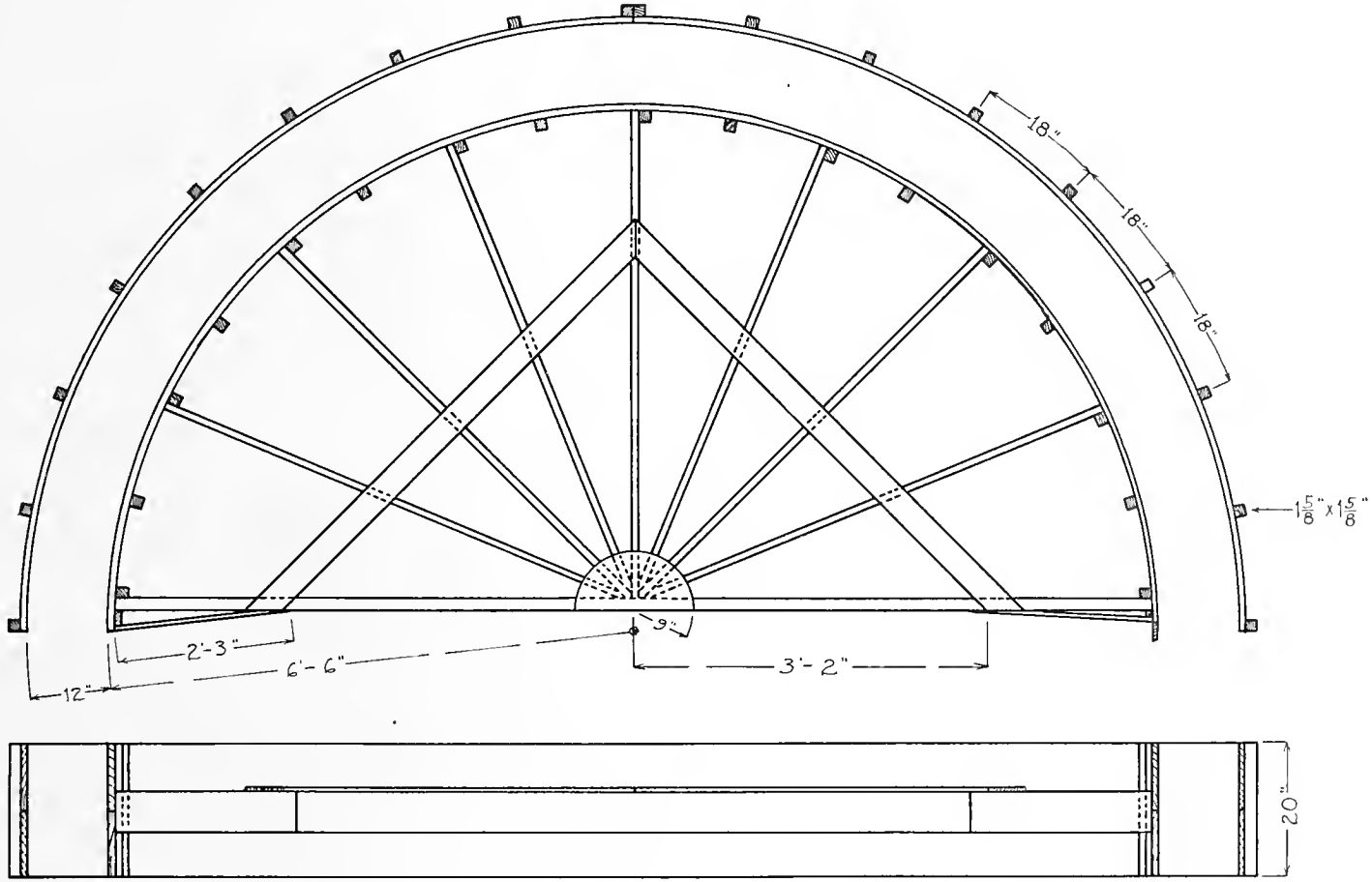
Tools. Saws, plane, square, rule, hammer and compass; large compass made of an 8′ strip of wood, nail and pencil; power circular saw.

Directions and Assembly. Before actual construction begins the six pieces $\frac{7}{8}$″ x 10″ x 14′ and pieces $\frac{7}{8}$″ x 10″ x 12′ should be sawed as shown in detail sheet. Saw the boards every six inches to the depth of $\frac{5}{8}$″ with a saw that cuts about $\frac{1}{8}$″ kerf. If the saw cuts a bigger kerf the space between saw cuts may be lengthened up to eight inches but this is not desirable. The boards bend better and more smoothly if cut 6″ apart, and they are less likely to break at the joints. While sawing it is just as well to rip the 2x4's into 2x2's since it will need to be done later.

After sawing these, the six boards 14′ long should be taken to a large tank, pond or stream where they are soaked for twenty-four hours or longer. These are not taken out until they are ready to be used. Weight or tie the boards entirely underneath the surface so that the sun will not affect them.

You are now ready to begin the construction of the "half wheels," as we will call them for conveience. Draw a straight line about fifteen feet long on the floor in some large open space. Using the center of this line and a $6\frac{1}{2}$′ radius draw a semi-circle. Lay off a point in the circumference on each side of the semi-circle 3″ from the diameter as shown in the detail. Put the 2x6 on these points to the inside. Allowing $\frac{7}{8}$″ on each end for the bending strips, mark and saw this 2x6 marked as D_1 to the required angle and length. Square end of $1\frac{1}{4}$″ piece and butt up against D_1 at center and mark off, being sure to allow $\frac{7}{8}$″ for bending strip. Saw and nail to D_1. Bevel the edges of one end of another $1\frac{1}{4}$″ piece to 45° angles and mark and saw D_3 and

CONCRETE FORM FOR SILO FOUNDATION



D_4. Nail these in. In like manner put in D_5, D_6, D_7 and D_8. Next put on D_9, D_{10} and D_{11}. Now you are ready for the 2x2's which have been sawed to 20″ in length. Nail these D_{12}, etc., on so that they will project an equal distance from the center of the spokes.

Make the other "half wheel" in like manner.

Get your material that has been soaking.

You are now ready to put on the rim of the "half wheel." Take two pieces of 6x6 or a pile of smaller pieces as shown at D_{13}, and elevate the spokes as shown in detail D. It requires two men at least to do this work, more are better. Nail on the first strip with its end three inches or more (if you can spare it) below the lower side of the 2x6, or first spoke of the wheel at D_{16}. One pupil should be nailing and the other holding the end at D_{15}. In the same manner nail a strip, beginning at the opposite side. With a third board splice out the space left open. If for some reason the boards do not join exactly over a 2x2, put in an extra one or a wide board about $\frac{7}{8}$″ x 6″ x 20″. When this is completed put in an extra 2x2 between the spokes where they are most needed as D_{17}. One is needed in each space. All this work should be done slowly and much common sense and patience must be exercised. The other half of the wheel is made in the same way.

You are now ready to complete the connections between the two half wheels. These are shown in details A_1 and A_2. It is necessary to make these in this way in order to allow the inner forms to be taken from the wall when the concrete has hardened. This lessens the chance of ruining the forms, for if they have to be pried out, it is almost sure to damage the forms. Cut a piece of $\frac{7}{8}$″ strip 20″ long just wide enough so that strip A_4 will come flush with the end of the rounded strip. Nail in this piece at A_3 to the rounded strip; then strip A_4 should be nailed to A_3. Force in rounded strip until it conforms to the $6\frac{1}{2}$′ circle and nail at A_6. The end A_2 should be finished in the same way only $1\frac{1}{2}$″ should be allowed for strip B shown in detail B. This strip B is not nailed to the form but is held in place by a prop when the form is set up. When taking out the forms this piece is first taken out, thus allowing enough play so that the forms may be lifted out easily.

The outer rim of the wheel is made in four sections. It is not absolutely necessary to soak the boards to be used, yet it renders them more pliable if soaked the first time they are used.

Cut twenty or more pieces one foot long and ten inches wide to be used between the rims of the wheel to keep it exactly one foot wide. Place the sections around the inner wheel. Use two sets of rods and the extension pieces that come with the silo and begin tightening. This will draw the outer form to a circular shape. As you near the size you wish put in the one foot pieces spoken of above and tighten until the outer and inner rims are just one foot apart. The one foot pieces may be removed after you have partly filled the forms.

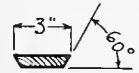
When placing the forms in position a great deal of care should be taken to have the top of the form perfectly level.

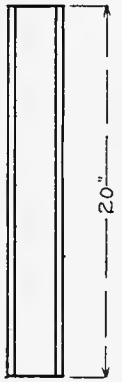
An ordinary hay frame is the most convenient means of transporting these forms.

When not in use keep the forms under cover or at least in the shade of a tree to prevent too much action from the sun.

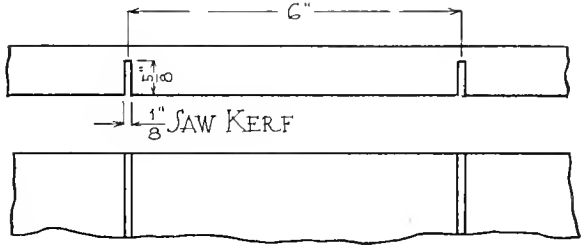
DETAILS OF SILO FORM CONSTRUCTION

DETAIL B

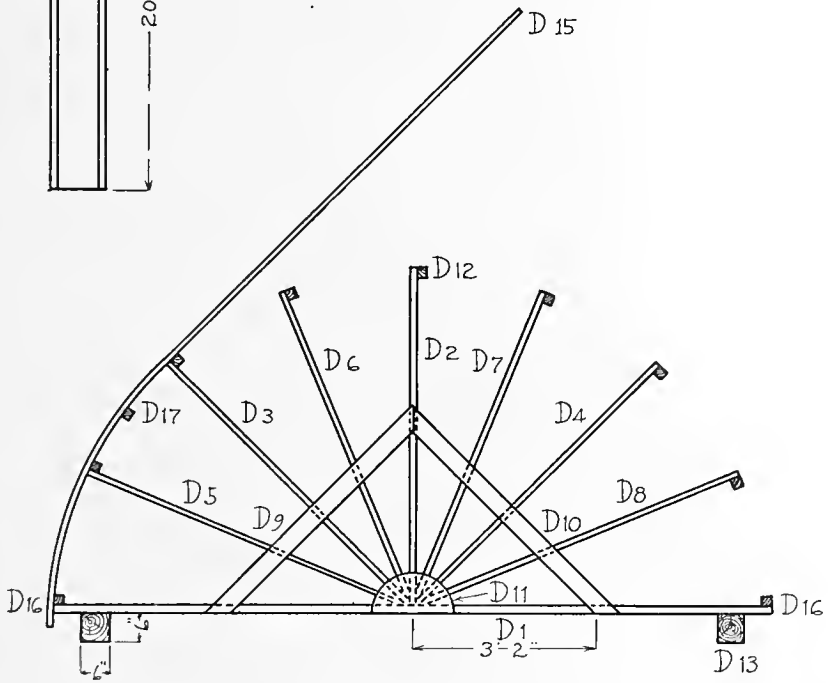




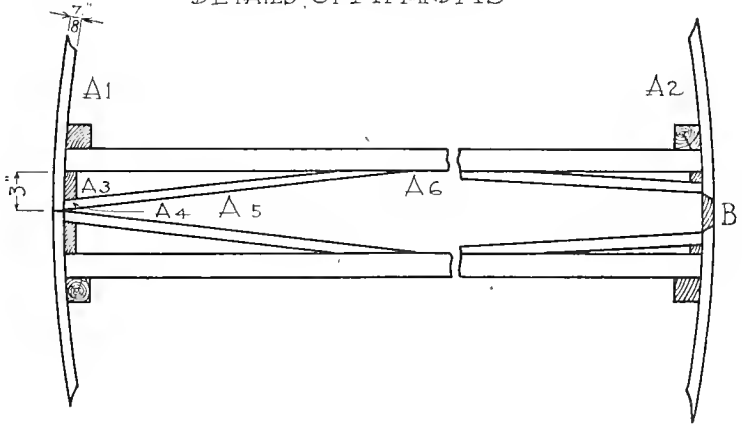
METHOD OF SAWING BOARDS TO MAKE THEM BEND



DETAIL D



DETAILS OF A1 AND A2



MOUSE PROOF CAGE FOR AGRICULTURAL EXHIBITS.

Purpose. In schools where agriculture is taught it is very difficult to keep wheat, oats, seeds in sheaf, and weed samples from being damaged by mice. This cage will give the necessary protection for the samples. Being screened on every side it allows free circulation of air both above and below the samples. It may be placed in such a way as to allow pupils to walk around it, viewing the samples from every side. It is high enough for a man to stand in, and wide enough to afford a path thru the middle after samples are hung on each side. The dimensions given in the drawing may be changed to suit the individual needs of the school or home.

Material.

Eight pieces 1¾″x3½″x12′.
Three pieces 1¾″x3½″x10′.
Four pieces ⅞″x10″x14′ shiplap.
One piece of galvanized screening 3′6″x37′.
One piece of galvanized screening 3′x48′.
One pair butt hinges.
One lock or catch of some kind.
A number of tin tacks and an assortment of nails.

Bill of Stock. Finished dimensions.

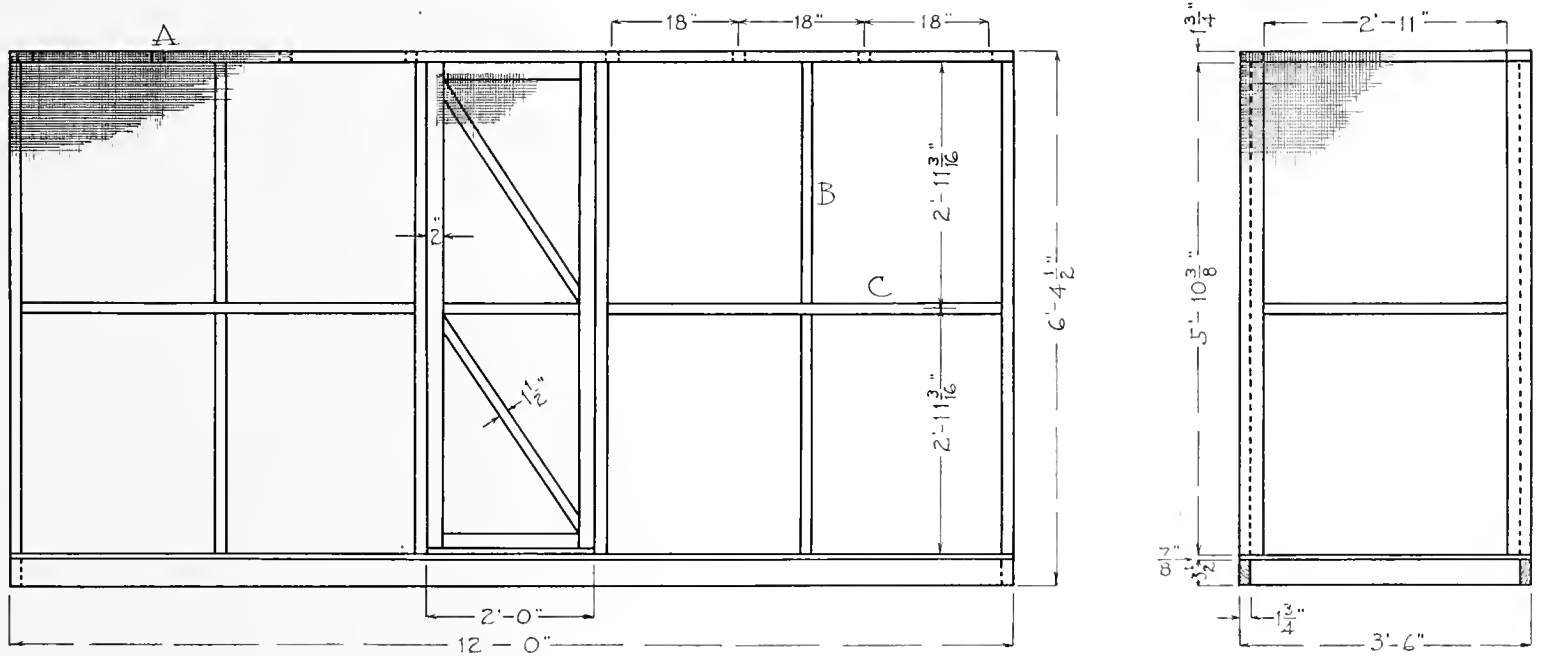
Four pieces 1¾″x3½″x12′ for platform and upper frame.
Two pieces 1¾″x3½″x3′2½″ for ends of platform.
Two pieces 1¾″x3½″x2′11″ for braces between upper corners.
Thirteen pieces ⅞″x10″x3′6″ shiplap for floor.
Six pieces 1¾″x3½″x5′10⅜″ for corners and door frame.
Eight pieces 1¾″x1¾″x2′11″ for screen braces.
Ten pieces 1¾″x1¾″x2′11⅝″ for screen braces.
One piece 1¾″x1¾″x11′8½″ for screen brace.
Two pieces 1¾″x1¾″x4′8½″ for screen braces.
One piece 1¾″x1¾″x11′8½″ for screen brace.
Two pieces ⅞″x2″x23″ for door.
One piece ⅞″x1½″x23″ for door.
Two pieces ⅞″x1½″x3′1″ for door.
One piece ⅞″x3″x24″ for threshold.

Tools. Saws, plane, square, rule, pencil, brace, ⅜″ bit, knife, and hammer.

Directions and Assembly. Saw all pieces to dimensions given in the bill of stock. The bottom platform should be made first, the shiplap being put on crosswise to give strength. Twelve feet of the 42″ screen is then laid and tacked over the platform to make the floor mouse proof. The main part of the frame is made of studding. The braces and inner parts used to support the screen are studding ripped into two parts. It is best to have these ripped with a power saw. In putting up the frame, first toe-nail the corner uprights, then nail on these the lengthwise pieces. Toe-nail in the cross-braces at the ends, and then the two pieces for the door frame. Nail in all the 1¾″ x 1¾″ braces for the screen.

After the frame has been completed, begin at either the left or right end and put on the 42″ screen over the end, top, and opposite end in one piece. Next put on the 36″ screen horizontally, and nail the screen across as it will be when finished. Do not nail bottom of screen on middle section until the lower screen is stretched. Both layers of screen may be nailed at once to the middle section making a neater and better job. (If the frame is to be painted or stained this should be done before the screen is put on.) Make an ordinary screen door to dimensions given in the drawing, and put on screen as in the rest of the problem. Hinge on the door and put on a lock or catch as desired.

MOUSE PROOF CAGE FOR AGRICULTURAL EXHIBITS



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